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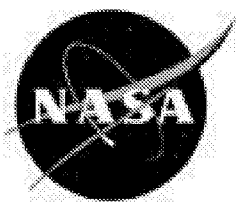
June 2000

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 416)

JUNE 2000

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft.

20000047290 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
New Metallic Materials for the Structure of Aging Aircraft *les Nouveaux Materiaux Metalliques Pour les Structures des a eronefs d Ancienne Generation*
New Metallic Materials for the Structure of Aging Aircraft; April 2000; 111p; In English, 19-20 Apr. 1999, Corfu, Greece; See also 20000047291 through 20000047296; Original contains color illustrations
Report No.(s): RTO-MP-25; AC/323(AVT)TP/13; ISBN 92-837-1029-0; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

This workshop dealt with the replacement of Structural component of aging aircraft with components manufactured from materials with specifications of a high qualification, with enhancing various parameters including overall life cycle cost technology (LCC). The following topics were treated: An Overview Aluminium Alloys and Composites Processing, Fatigue and Durability.
Author
Replacing; Aging (Materials); Aluminum Alloys; Fatigue (Materials); Durability

20000053157 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Structural Aspects of Flexible Aircraft Control *Les Aspects Structuraux du Controle Actif et Flexible des Aeronefs*
Structural Aspects of Flexible Aircraft Control; May 2000; 295p; In English; Specialists' Meeting of the RTO Applied Vehicle Technology Panel (AVT): Structural Aspects of Flexible Aircraft Control, 18-20 Oct. 1999, Ottawa, Ontario, Canada; See also 20000053158 through 20000053182; CD-ROM contains full text document in pdf format
Report No.(s): RTO-MP-36; AC/323(AVT)TP/17; ISBN 92-837-0014-7; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche; C01, CD-ROM

The specialists' meeting dealt with design issues and more specifically Structural Aspects of Flexible Aircraft Control. Twenty six papers and a keynote address were presented with the following objectives: How the design methods used in the development of military fighter aircraft can be improved, and applied to transport aircraft design applications. There were three sessions covering the following topics: (1) Aeroservoelasticity; (2) Active Control for Flexible Structures I; and (3) Active Control for Flexible Structures II.
Author
Flight Control; Fighter Aircraft; Aircraft Design; Aeroservoelasticity; Transport Aircraft; Flexible Bodies; Control Systems Design

20000053171 NASA Langley Research Center, Hampton, VA USA
Research Activities within NASA's Morphing Program
McGowan, Anna–Maria R., NASA Langley Research Center, USA; Horta, Lucas G., NASA Langley Research Center, USA; Harrison, Joycelyn S., NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 13-1 - 13-10; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

In the last decade, smart technologies have become important enabling technologies that cut across traditional boundaries in science and engineering. Here smart is defined as the ability to respond to a stimulus in a predictable and reproducible manner.

While multiple successes have been achieved in the laboratory, we have yet to see the general applicability of smart technologies to actual aircraft and spacecraft. The NASA Morphing program is an attempt to couple research across a wide range of disciplines to integrate smart technologies into high payoff applications on aircraft and spacecraft. The program bridges research in several technical disciplines and combines the effort into applications that include active aerodynamic control, active aeroelastic control, and vehicle performance improvement. System studies are used to assess the highest-payoff program objectives, and specific research activities are defined to address the technologies required for development of smart aircraft and spacecraft. This paper will discuss the overall goals of NASA's Morphing program, highlight some of the recent research efforts and discuss the multidisciplinary studies that support that research and some of the challenges associated with bringing the smart technologies to real applications on flight vehicles.
Author
NASA Programs; Smart Structures; Active Control; Aeroelasticity; Technology Assessment

20000053522 Technische Univ., Delft, Netherlands
Aeroelastic Stability of Modern Wind Turbines. STABTOOL, Phase 1 *Final Report*
VanHolten, T., Technische Univ., Netherlands; Pavel, M. D., Technische Univ., Netherlands; Smits, G. N., Technische Univ., Netherlands; Sep. 1999; 60p; In English; Prepared in cooperation with Netherlands Energy Research Foundation ECN, The Hague. Sponsored in part by Nederlandse Maatschappij voor Energie en Mileiu B.V., Sittard
Report No.(s): PB2000-103700; MEMORANDUM-M-880; Copyright; Avail: National Technical Information Service (NTIS)

In this report an overview and evaluation is given of the possible aeroelastic instabilities, which can occur in future large wind turbines. A literature survey was performed looking at aeroelastic instabilities in both the helicopter and wind turbine world. The survey gave a good overview of instabilities in helicopters and wind turbines. to obtain more knowledge of relevant properties, which determine the elastic configurations of modern and future wind turbines, current wind turbine configurations have been evaluated and three wind turbines were selected for upscaling. A quantitative and qualitative analysis of the selected wind turbines (using prediction methods as well as scaling laws and plain physics) showed two types of instabilities, which could be potentially dangerous.
NTIS
Wind Turbines; Aeroelasticity; Quantitative Analysis; Prediction Analysis Techniques

20000054538 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 415
May 2000; 103p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL415; NAS 1.21:7037/SUPPL415; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-2000-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.
CASI
Aerodynamics; Aeronautical Engineering; Bibliographies; Indexes (Documentation)

20000056096 NASA Glenn Research Center, Cleveland, OH USA
Research and Technology, *FY 1999*
March 2000; 200p; In English
Report No.(s): NASA/TM-2000-209639; E-11969; NAS 1.15:209639; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This report selectively summarizes the NASA Glenn Research Center's research and technology accomplishments for the fiscal year 1999. It comprises 130 short articles submitted by the staff scientists and engineers. The report is organized into four major sections: Aeronautics. Research and Technology, Space, and Engineering and Technical Services. A table of contents and an author index have been developed to assist readers in finding articles of special interest. This report is not intended to be a comprehensive summary of all the research and technology work done over the past fiscal year. Most of the work is reported in

Glenn-published technical reports, journal articles, and presentations prepared by Glenn staff and contractors. In addition, university grants have enabled faculty members and graduate students to engage in sponsored research that is reported at technical meetings or in journal articles. For each article in this report, a Glenn contact person has been identified, and where possible, reference documents are listed so that additional information can be easily obtained. The diversity of topics attests to the breadth of research and technology being pursued and to the skill mix of the staff that makes it possible. For more information about research at NASA Glenn, visit us on the World Wide Web (http://www.grc.nasa.gov). This document is available on the World Wide Web (http://www.grc.nasa.gov/WWW/RT/). For publicly available reports, visit the Glenn Technical Report Server (GLTRS) on the World Wide Web (http://gltrs.grc.nasa.gov/GLTRS/).

Author

Research and Development; NASA Programs; Technology Utilization; Technology Transfer; Propulsion; Materials; Microgravity

20000056103 Southwest Research Inst., San Antonio, TX USA

Separating the Role of Regolith Adsorption vs. Polar Cap Development and Retreat in the North Polar Region of Mars

Bass, D. S., Southwest Research Inst., USA; Paige, D. A., California Univ., USA; The First International Conference on Mars Polar Science and Exploration; [1998], pp. 1; In English; See also 20000056101; No Copyright; Avail: Issuing Activity; Abstract Only

Viking Infrared Thermal Mapper surface temperature (T(sub 20)) and Mars Atmospheric Water Detector (MAWD) atmospheric water vapor data show that although some water vapor sublimes into the atmosphere as the seasonal CO2 cap retreated beyond the warm polar sand sea by L(sub s) = 81.55, the bulk of the water vapor did not enter the atmosphere until the center of the north residual polar cap heated to beyond 200 K at approximately L(sub s) = 103. We suggest the discrepancy in the timing of increasing local atmospheric water vapor may indicate the source for the additional water frost appearing on the cap; on measurable timescales, it does not appear that the water vapor is moving directly into the atmosphere from the regolith or the cap surface. If this were the case, there would be a gradual increase of water vapor in the atmosphere as the CO2 cap sublimated. Rather, it appears that the water vapor is moving toward the cap center through its recondensation onto the cap surface along with the retreating CO2 frost. There is a brief time lag between the darkening of the cap and the appearance of a large amount of water vapor in the atmosphere over the residual polar cap; atmospheric water vapor amounts peak at L(sub s) = 111. The time lag indicates that a local temperature differential governs some water transport in the north polar region; some water is released into the atmosphere as the surface heats up.

Author

Mars Surface; Polar Caps; Polar Regions; Regolith; Water Vapor

20000057219 NASA Langley Research Center, Hampton, VA USA

First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop, Pt. 2

Wood, Richard M., Editor, NASA Langley Research Center, USA; First NASA/Industry High-Speed research Configuration Aerodynamics Workshop; December 1999; 530p; In English; 1st; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop, 27-29 February 1996, Hampton, VA, USA; Sponsored by NASA Langley Research Center, USA; See also 20000057220 through 20000057236

Contract(s)/Grant(s): RTOP 537-07-20-20

Report No.(s): NASA/CP-1999-209690/PT2; L-17574B; NAS 1.55:209690/PT2; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

This publication is a compilation of documents presented at the First NASA Industry High Speed Research Configuration Aerodynamics Workshop held on February 27-29, 1996 at NASA Langley Research Center. The purpose of the workshop was to bring together the broad spectrum of aerodynamicists, engineers, and scientists working within the Configuration Aerodynamics element of the HSR Program to collectively evaluate the technology status and to define the needs within Computational Fluid Dynamics (CFD) Analysis Methodology, Aerodynamic Shape Design, Propulsion/Airframe Integration (PAI), Aerodynamic Performance, and Stability and Control (S&C) to support the development of an economically viable High Speed Civil Transport (HSCT) aircraft. to meet these objectives, papers were presented by representatives from NASA Langley, Ames, and Lewis Research Centers; Boeing, McDonnell Douglas, Northrop-Grumman, Lockheed-Martin, Vigyan, Analytical Services, Dynacs, and RIACS.

Author

Supersonic Transports; Aircraft Design; Aerodynamic Configurations; Aircraft Configurations; Engine Airframe Integration; Conferences

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery.

20000044865 NASA Langley Research Center, Hampton, VA USA
First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop
Wood, Richard M., Editor, NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999; 626p; In English; 1st, 27-29 Feb. 1996, Hampton, VA, USA; See also 20000044866 through 20000044881
Contract(s)/Grant(s): RTOP 537-07-20
Report No.(s): NASA/CP-1999-209690/PT3; NAS 1.55:209690/PT3; L-17574C; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This publication is a compilation of documents presented at the First NASA/Industry High Speed Research Configuration Aerodynamics Workshop held on February 27-29, 1996 at NASA Langley Research Center. The purpose of the workshop was to bring together the broad spectrum of aerodynamicists, engineers, and scientists working within the Configuration Aerodynamics element of the HSR Program to collectively evaluate the technology status and to define the needs within Computational Fluid Dynamics (CFD) Analysis Methodology, Aerodynamic Shape ly, Desic,n, Propulsion/Airframe Integration (PAI), Aerodynamic Performance, and Stability and Control (S&C) to support the development of an economically viable High Speed Civil Transport (HSCT) aircraft. to meet these objectives, papers were presented by representative from NASA Langley, Ames, and Lewis Research Centers; Boeing, McDonnell Douglas, Northrop-Grumman, Lockheed-Martin, Vigyan, Analytical Services, Dynacs, and RIACS.
Author
Aerodynamic Characteristics; Aerodynamic Configurations; Engine Airframe Integration; Aerodynamics; Computational Fluid Dynamics

20000044870 NASA Langley Research Center, Hampton, VA USA
Initial Results of Reynolds Number Testing at LaRC's NTF Using the 2.2% Reference H Model
Owens, Lewis R., Jr., Editor, NASA Langley Research Center, USA; Wahls, Richard A., Editor, NASA Langley Research Center, USA; Hamner, Marvine, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1073-1107; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

To develop full scale flight performance predictions an understanding of Reynolds number effects on HSCT-class configurations is essential. A wind tunnel database utilizing a 2.2% scale Reference H model in NASA Langley Research Centers National Transonic Facility is being developed to assess these Reynolds number effects. In developing this database temperature and aeroelastic corrections to the wind tunnel data have been identified and are being analyzed. Once final corrections have been developed and applied, then pure Reynolds number effects can be determined. In addition, final corrections will yield the data required for CFD validation at q = 0. Presented in this report are the results of seven tests involving the wing/body configuration. This includes summaries of data acquired in these tests, uncorrected Reynolds number effects, and temperature and aeroelastic corrections. The data presented herein illustrates the successes achieved to date as well as the challenges that will be faced in obtaining full scale flight performance predictions.
Author
Scale Models; Flight Characteristics; Aircraft Performance; Performance Prediction; Reynolds Number

20000044871 Boeing Commercial Airplane Co., Seattle, WA USA
HSCT Ref-H Transonic Flap Data Base: Wind-Tunnel Test and Comparison with Theory
Vijgen, Paul M., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1109-1141; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In cooperation with personnel from the Boeing ANP Laboratory and NASA Langley, a performance test was conducted using the Reference-H 1.675% model ("NASA Modular Model") without nacelles at the NASA Langley 16-Ft Transonic Tunnel. The main objective of the test was to determine the drag reduction achievable with leading-edge and trailing-edge flaps deflected along the outboard wing span at transonic Mach numbers (M = 0.9 to 1.2) for purpose of preliminary design and for comparison with computational predictions. The obtained drag data with flap deflections for Mach numbers of 1.07 to 1.20 are unique for the

Reference H wing. Four leading-edge and two trailing-edge flap deflection angles were tested at a mean-wing chord-Reynolds number of about 5.7 million. An outboard-wing leading-edge flap deflection of 81 provides a 4.5 percent drag reduction at M = 1.2 A = 0.2), and much larger values at lower Mach numbers with larger flap deflections. The present results for the baseline (no flaps deflected) compare reasonably well with previous Boeing and NASA Ref-H tunnel tests, including high-Reynolds number NTF results. Viscous CFD simulations using the OVERFLOW thin-layer N.S. method properly predict the observed trend in drag reduction at M = 1.2 as function of leading-edge flap deflection. Modified linear theory properly predicts the flap effects on drag at subsonic conditions (Aero2S code), and properly predicts the absolute drag for the 40 and 80 leading-edge deflection at M = 1.2 (A389 code).

Author

Performance Tests; Transonic Wind Tunnels; Wind Tunnel Tests; Aerodynamic Configurations; Aircraft Models; Wind Tunnel Models; Leading Edge Flaps; Leading Edges; Trailing Edge Flaps; Nacelles

20000044872 DYNACS Engineering Co., Inc., Renton, WA USA

Assessment of Ref. H HSCT Transonic Flap and Reynolds Number Effects with the OVERFLOW Code

Kandula, Max, DYNACS Engineering Co., Inc., USA; Sheckler, Ross, DYNACS Engineering Co., Inc., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1143-1183; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Transonic flap effects on the aerodynamic performance of Ref. H HSCT wing/body configuration have been analyzed using the OVERFLOW thin-layer Navier-Stokes code. Flap deflection effects at freestream Mach numbers M=0.9 (10/3 deg LE/TE at Re=5.8E6 and 30E6 based on the mean aerodynamic chord, and M=1.2 (10/0 deg and 8/0 deg LE/TE at Re=5.8E6) for a range of angle of attack alpha = 0 to 8 deg are investigated. The predictions from the CFD analysis are correlated with the NTF (M=0.9 at Re=3OE6) and LaRC-16T (M=1.2 at Re=5.8E6) wind tunnel data. Surface grids are generated using Gridgen-2D elliptic grid generator in conjunction with GRIDTOOL for database projection. Volume grids are developed with the HYPGEN hyperbolic grid generator. The volume grid communication is carried out using the PEGSUS code based on Chimera overlapping scheme. Flow solutions are obtained with OVERFLOW code (central-differencing option) with the Baldwin-Barth one-equation turbulence model. Boeing HSCT High Speed Aerodynamics provided the baseline (flaps-up 0/0 deg LE/TE) CFD results and the wind tunnel data presented here. In general the OVERFLOW Navier-Stokes CFD computations correlated well with the NTF and LaRC-16T data for forces, drag polar and pitching moments. The computed drag at low alpha is in general underpredicted, while the computed pitching moment at high alpha deviates appreciably from the data. Calculations for the 10/3 deg flaps at M=0.9 and Re=5.8E6 and 30E6 have indicated that the main effect of Re on the 10/3 deg flaps is seen on the wing upper surface downstream of the the hinge lines. For Re=5.8E6, a separation is noted on the upper surface downstream of the hinge line whereas no separation is observed at higher Reynolds number. The OVERFLOW calculations for the 10/0 deg and the 8/0 deg flaps at M=1.2 correlate well with the LaRC-16T data which show that in the range of alpha = 3 to 8 deg, the 8/0 deg flap performs better than the 10/0 deg flaps relative to the baseline case.

Author

Aerodynamic Characteristics; Airfoil Profiles; Body-Wing Configurations; Aerodynamic Configurations; Aircraft Models; Wind Tunnel Tests; Flow Visualization; Wind Tunnel Models; Performance Prediction; Computational Fluid Dynamics

20000044873 NASA Langley Research Center, Hampton, VA USA

Turbulence Model Comparisons and Reynolds Number Effects Over a High-Speed Aircraft at Transonic Speeds

Rivers, Melissa B., NASA Langley Research Center, USA; Wahls, Richard A., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1185-1214; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper gives the results of a grid study, a turbulence model study, and a Reynolds number effect study for transonic flows over a high-speed aircraft using the thin-layer, upwind, Navier-Stokes CFL3D code. The four turbulence models evaluated are the algebraic Baldwin-Lomax model with the Degani-Schiff modifications, the one-equation Baldwin-Barth model, the one-equation Spalart-Allmaras model, and Menter's two-equation Shear-Stress-Transport (SST) model. The flow conditions, which correspond to tests performed in the NASA Langley National Transonic Facility (NTF), are a Mach number of 0.90 and a Reynolds number of 30 million based on chord for a range of angle-of-attacks (1 degree to 10 degrees). For the Reynolds number effect study, Reynolds numbers of 10 and 80 million based on chord were also evaluated. Computed forces and surface pressures compare reasonably well with the experimental data for all four of the turbulence models. The Baldwin-Lomax model with the Degani-Schiff modifications and the one-equation Baldwin-Barth model show the best agreement with experiment overall. The Reynolds number effects are evaluated using the Baldwin-Lomax with the Degani-Schiff modifications and the Baldwin-Barth

turbulence models. Five angles-of-attack were evaluated for the Reynolds number effect study at three different Reynolds numbers. More work is needed to determine the ability of CFL3D to accurately predict Reynolds number effects.
Author
Baldwin-Lomax Turbulence Model; Turbulent Flow; Reynolds Number; Transonic Flow; Transonic Wind Tunnels; Computational Fluid Dynamics; Grid Generation (Mathematics); Upwind Schemes (Mathematics); Navier-Stokes Equation; Mathematical Models; Wind Tunnel Models

20000044877 NASA Ames Research Center, Moffett Field, CA USA
Simulated Inlet Unstart and Nacelle/Diverter Effects for the Boeing Reference H Configuration
Cliff, Susan E., NASA Ames Research Center, USA; Baker, Timothy J., Princeton Univ., USA; Thomas, Scott D.; Aguayo, Ernest D.; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1285-1325; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Boeing Reference H configuration was tested in the NASA Ames 9x7 Supersonic Wind Tunnel. A simulated unstarted inlet was evaluated as well as the aerodynamic performance of the configuration with and without nacelle and diverter components. These experimental results were compared with computational results from the unstructured grid Euler flow solver AIRPLANE. The comparisons between computational and experimental results were good, and demonstrated that the Euler code is capable of efficiently and accurately predicting the changes in the aerodynamic coefficients associated with inlet unstart and the effects of the nacelle and diverter components.
Author
Aerodynamic Configurations; Wind Tunnel Models; Aircraft Models; Supersonic Wind Tunnels; Wind Tunnel Tests; Aerodynamic Characteristics

20000044878 McDonnell-Douglas Aerospace, Long Beach, CA USA
Wing Leading-Edge Geometry Effects on High-Lift Performance
Hoyle, David L., McDonnell-Douglas Aerospace, USA; Hamner, Marvine, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1327-1343; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The purpose of this study was to gain insight into how wing geometries optimized for high-speed cruise performance performed at low-speed, high-lift conditions. The highly-swept HSR planforms attempt to maximize L/D by using simple-hinged leading-edge flaps to maintain attached flow over the wing during takeoff and landing. Wing leading edge parameters such as leading-edge radius and thickness distribution are typically defined to maximize high-speed cruise performance. This study shows that these parameters also play a crucial role in achieving the high-lift UD's needed to meet minimum noise requirements. Wind tunnel test data recently obtained on an arrow wing configuration yielded a maximum trimmed high-lift UD of only 6.9. The current trimmed high-lift UD metric for this planform is 8.2. Much of the deficiency in L/D was believed to arise from the wing leading edge definition. Wing geometry modifications to both the leading-edge radius and thickness have been analyzed using higher-order CFD methods. It is estimated that implementing these simple changes could increase the high-lift UD's obtained by 1.0 to 1.5. This would correspond to a noise decrease of over 1.5 dB at engine cutback. Additional work needs to be done to determine the trade-offs in wing leading-edge design to maximize both the high-speed cruise and the high-lift performance.
Author
Body-Wing Configurations; Arrow Wings; Leading Edges; Aircraft Design; Aircraft Performance

20000044879 Boeing Commercial Airplane Co., Seattle, WA USA
Impact of Alternate Concepts for Wing Platform, Leading Edge Flaps, and Trim Configuration on the High Lift Performance of the Ref H HSCT
Wyatt, G. H., Boeing Commercial Airplane Co., USA; Visser, K. D., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1345-1373; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This report will cover: 1. High lift aerodynamics overview. 2. The Technology Concept Airplane baseline, its sizing criteria, sensitivity of L/D to noise, and cutback L/D projections for the TCA. 3. A description of the 6% Ref H high lift model and mounting in the 14x22 facility. 4. Results of alternate planform testing, 5. Results of leading edge flap optimization testing, 6. Results of alternate trim concept testing.
Derived from text
Aerodynamics; Aerodynamic Configurations; Canard Configurations; Leading Edge Flaps; Wing Planforms

20000044880 DYNACS Engineering Co., Inc., Renton, WA USA

Assessment of CFD Codes for HSCT Ref. H High Lift Aerodynamics

Saladino, Anthony J., DYNACS Engineering Co., Inc., USA; Sheckler, Ross D., DYNACS Engineering Co., Inc., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1375-1406; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

One of the high lift aerodynamics tasks for 1995 was to assess the applicability of using various CFD codes in predicting wind tunnel data for the Ref. H configuration at high speed and low speed conditions. Both the Euler and the Navier-Stokes methodologies have been utilized and the lift, drag, moment and pressure coefficients have been compared with the NASA Langley 14x22 wind tunnel data, test 404, run 195. The conditions that were tested correspond to a 6% Ref. H wing/body at a Reynolds number of 8.8 million, with flap settings of LE 30 deg/outboard TE 20 deg, Mach number of 0.24 and angle-of-attack of 10 deg. Five CFD codes were chosen for this study: the structured grid codes are CFL3D, TNSMB, INS3D, and OVERFLOW; the unstructured grid code is USM3D. Separate Euler and viscous grids were used in the structured code runs. Two unstructured grids with different hinge line radius, leading and trailing edge detail were developed for the inviscid USM3D code. The wind tunnel data base includes pressure coefficients at seven spanwise cuts and five chordwise cuts, the aerodynamic coefficients C(sub L), C(sub D) and C(sub M), and mini-tuft data. Comparisons between CFD and wind tunnel data will be shown for one spanwise cut (X=2389.75 inches) and two chordwise cuts (Y=286.50 and 481.75 inches), along with comparisons between mini-tuft data and CFD velocity vectors.

Author

Computational Fluid Dynamics; Wind Tunnel Tests; Navier-Stokes Equation; Structured Grids (Mathematics); Unstructured Grids (Mathematics); Grid Generation (Mathematics); Euler Equations of Motion; Body-Wing Configurations

20000045988 NASA Langley Research Center, Hampton, VA USA

1997 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 1, Configuration Aerodynamics

Baize, Daniel G., Editor, NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; 802p; In English, 25-28 Feb. 1997, Hampton, VA, USA; See also 20000045989 through 20000046006; Original contains color illustrations

Contract(s)/Grant(s): RTOP 537-07-00

Report No.(s): NASA/CP-1999-209691/VOL1/PT1; L-17916B/VOL1/PT1; NAS 1.55:209691/VOL1/PT1; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The High-Speed Research Program and NASA Langley Research Center sponsored the NASA High-Speed Research Program Aerodynamic Performance Workshop on February 25-28, 1997. The workshop was designed to bring together NASA and industry High-Speed Civil Transport (HSCT) Aerodynamic Performance technology development participants in areas of Configuration Aerodynamics (transonic and supersonic cruise drag prediction and minimization), High-Lift, Flight Controls, Supersonic Laminar Flow Control, and Sonic Boom Prediction. The workshop objectives were to (1) report the progress and status of HSCT aerodynamic performance technology development; (2) disseminate this technology within the appropriate technical communities; and (3) promote synergy among the scientist and engineers working HSCT aerodynamics. In particular, single- and multi-point optimized HSCT configurations, HSCT high-lift system performance predictions, and HSCT Motion Simulator results were presented along with executive summaries for all the Aerodynamic Performance technology areas.

Author

Aerodynamic Characteristics; Aerodynamic Configurations; Civil Aviation; Supersonic Transports; High Speed

20000045989 McDonnell-Douglas Aerospace, Long Beach, CA USA

Enhancements of CFL3Dhp Parallel Code and Its HSR Applications

Sundaram, Pichuraman, McDonnell-Douglas Aerospace, USA; Novean, Mike, McDonnell-Douglas Aerospace, USA; Cheung, Samson, McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 5-42; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents the recent progress made and the results obtained in the area of parallel computing for the CFD analysis of large HSR configurations. The code used for the present study is CFL3Dhp, a coarse-grain parallel version of the MDC Configuration Aerodynamics group work-horse Euler/Navier-Stokes analysis and nonlinear design code, CFL3D. The original parallelization of the code was carded out by Computer Sciences Corporation under contract from NASA LaRC. The parallel version of the code uses MPI as the message passing language and can be used'in a heterogeneous distributed computing environment. Several enhancements to the code have been made at MDC including the addition of a full restart capability as well

as making it more user friendly. The successful application of the code on a parallel platform, the IBM SP-2 system for several HSCT configurations are demonstrated. Also, the application of the code on other shared memory platforms such as Cray Q-90 and the J-90 cluster are also highlighted. The results obtained show the promise of using this code for large CFD problems in HSCT analysis and design with rapid turn-around.
Author
Computational Fluid Dynamics; Parallel Processing (Computers); Supersonic Transports; Aerodynamic Configurations; Applications Programs (Computers)

20000045992 McDonnell-Douglas Corp., Long Beach, CA USA
Improvements to the MDC Nonlinear Aerodynamic Design Tools
Hager, James O., McDonnell-Douglas Corp., USA; Hartwich, Peter M., McDonnell-Douglas Corp., USA; Unger, Eric R., McDonnell-Douglas Corp., USA; Kuruvila, Geojoe, McDonnell-Douglas Corp., USA; Narducci, Robert P., McDonnell-Douglas Corp., USA; Agrawal, Shreekant, McDonnell-Douglas Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 189-254; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

Nonlinear aerodynamic optimization is considered a key technology required to develop a High Speed Civil Transport (HSCT). Within the High Speed Research (HSR) program, McDonnell Douglas is developing nonlinear optimization tools to be able to support the launch of an HSCT program at the end of HSR II. This paper presents recent improvements to the tools. The first set of improvements were made to be able to optimize the Technology Concept Aircraft (TCA). The TCA presented some grid generation issues because it is a true low-wing configuration. In addition, several constraints were required to maintain a realistic design. Second, the geometry modeling capability was improved to move toward full-configuration modeling. Empennage effects have been modeled, and wing/body/flaps configurations can be modeled. Efforts were also made to produce and improve tools required for integrated wing/body/nacelle/ diverter modeling. Third, alternate gradient evaluation techniques are being examined to replace the finite-difference'calculations currently being used. ADIFOR was applied to CFL3D and demonstrated for a 100+ design-variable problem. Also, an. adjoint module is being created for TLNS3D. Finally, a transition is being made to a modular design environment to facilitate improvements and the addition of new codes.
Author
Aerodynamic Configurations; Civil Aviation; Design Analysis; Nonlinearity; Supersonic Transports; Optimization

20000045994 McDonnell-Douglas Aerospace, Long Beach, CA USA
Isolated and Installed Nozzle Boattail Drag Studies
Wallace, Hoyt, McDonnell-Douglas Aerospace, USA; Sundaram, Pichuraman, McDonnell-Douglas Aerospace, USA; Arslan, Alan E., McDonnell-Douglas Aerospace, USA; Shieh, Chih–Fang, McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 305-374; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

As part of the FY95 transonic nozzle boattail drag study for the Reference H configuration, the McDonnell Douglas (MDC) task included the axisymmetric nozzle assessment while Northrop Grumman (NGC) studied the 2-D nozzle geometry. The 2-D nozzle was a simulation of the baseline nozzle as of March 1995, while the axisymmetric nozzle was the equivalent body of revolution. Boattail settings representing transonic operation (i.e., small exit area) and the wideopen, supersonic reference nozzle were analyzed. During the course of the investigation, significant difficulties were experienced and hence the results of the axisymmetric supersonic nozzle geometry could not be obtained. As a result, the study was continued (although with minimal effort) this past year to complete the axisymmetric nozzle geometry. A new grid was generated with a modified topology, first for the installed axisymmetric supersonic nozzle configuration and later for the axisymmetric transonic nozzle (solution repeated for consistency) configuration. After successfully obtaining the CFL3D Navier-Stokes results for the axisymmetric installed nozzle geometry at M (sub infinity) = 0.9, the study was continued for the 2-D installed transonic nozzle configuration as well, to ensure consistency in the comparison of the axisymmetric and 2-D nozzle results. Solutions for the four isolated nacelles have been obtained at both Mach 0.9 and 1.10. The solutions for the installed axisymmetric supersonic nozzle configuration at Mach 1.10 and for the 2-D installed transonic nozzle configuration at either Mach 0.9 or Mach 1.10 have not been obtained as of this writing. However, the results to date indicated the following: (1) the drag of the isolated axisymmetric transonic nozzle was slightly less that that of the 2-D nozzle at both Mach 0.9 and 1.10; (2) the interference drag for both the axisymmetric and 2-D nacelles are nearly identical at Mach 0.90.
Author
Boattails; Two Dimensional Flow; Transonic Nozzles; Civil Aviation; Computational Fluid Dynamics; Aerodynamic Drag; Nozzle Geometry; Wind Tunnel Tests

20000046001 NASA Langley Research Center, Hampton, VA USA

Prediction and Assessment of Reynolds Number Sensitivities Associated with Wing Leading-Edge Radius Variations

Wahls, Richard A., NASA Langley Research Center, USA; Rivers, Melissa B., NASA Langley Research Center, USA; Owen, Lewis R., Jr., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 588-610; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The primary objectives of this study were to expand the data base showing the effects of LE radius distribution and corresponding . sensitivity to Rn at subsonic and transonic conditions, and to assess the predictive capability of CFD for these effects. Several key elements led to the initiation of this project: 1) the necessity of meeting multipoint design requirements to enable a viable HSCT, 2) the demonstration that blunt supersonic leading-edges can be associated with performance gain at supersonic speeds , and 3) limited data. A test of a modified Reference H model with the TCA planform and 2 LE radius distributions was performed in the NTF, in addition to Navier-Stokes analysis for an additional 3 LE radius distributions. Results indicate that there is a tremendous potential to improve high-lift performance through the use of a blunt LE across the span given an integrated, fully optimized design, and that low Rn data alone is probably not sufficient to demonstrate the benefit.
Author

Prediction Analysis Techniques; Radii; Reynolds Number; Sensitivity; Computational Fluid Dynamics; Supersonic Transports; Leading Edge Flaps

20000046002 NASA Langley Research Center, Hampton, VA USA

Preliminary Results of the 1.5% TCA (Modular) Controls Model in the NASA Langley UPWT

Kubiatko, Paul, McDonnell-Douglas Aerospace, USA; McMillin, Naomi, NASA Langley Research Center, USA; Cameron, Douglas C., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 612-668; In English; See also 20000045988; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

To summarize the significant highlights in this report: (1) Data quality, determined by multiple repeat runs performed on the TCA baseline configuration, and long-term repeatability, determined by comparing baseline Reference H data from this test to a previous test, have been shown to be good. (2) The longitudinal stability of the TCA is more non-linear than for the Reference H, and while it is similar at normal lift values, the TCA has considerably more pitch-up at higher lift. (3) Longitudinal control effectiveness of the TCA is similar to the Reference H and the ratio of elevator effectiveness to horizontal tail effectiveness is approximately 0.3. 4) The directional stability of the TCA is improved relative to Reference H at higher angles-of attack. The chine is effective for improving directional stability. (5) The directional control effectiveness 'of the TCA rudder is the same as that of the Reference H rudder at low angles-of-attack, after taking factors, such as number of rudder panels deflected and vertical tail volume into account. However, rudder effectiveness was shown to be reduced at higher angles-of-attack. (6) The lateral stability was shown to be reduced relative to the Reference H, which may be beneficial at low speeds for alleviating lateral control saturation. (7) Lateral control effectiveness for the TCA was shown to be similar to the Reference H for negative trailing-edge flap deflections and was reduced by approximately 25% for positive trailing-edge flap deflections.
Derived from text

Wind Tunnel Tests; Civil Aviation; Controllability; Aircraft Models; Aerodynamic Characteristics

20000046003 NASA Langley Research Center, Hampton, VA USA

Effect of Boattail and Sidewall Curvature on Nozzle Drag Characteristics

Capone, Francis J., NASA Langley Research Center, USA; Deere, Karen A., NASA Langley Research Center, USA; Bangert, Linda S., NASA Langley Research Center, USA; Pao, Paul S., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 669-706; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The NASA-industry team has sponsored several studies in the last two years to address the installed nozzle boattail drag issues. Some early studies suggested that nozzle boattail drag could be as much as 25 to 40 percent of the subsonic cruise. As part of this study tests have been conducted at NASA-Langley to determine the uninstalled drag characteristics of a proposed nozzle. The overall objective was to determine the effects of nozzle external flap curvature and sidewall boattail variations. This test would also provide data for validating CFD predictions of nozzle boattail drag.
Derived from text

Boattails; Curvature; Nozzle Geometry; Aerodynamic Drag; Computational Fluid Dynamics; Supersonic Speed

20000046004 Boeing Co., Boeing Commercial Airplane Group, Seattle, WA USA
Development of TCA Flight Drag Polars for Airplane Performance
Nelson, Chester P., Boeing Co., USA; Adamson, Eric E., Boeing Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 707-727; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

In early 1996 the NASA-industry High Speed Research Technical Integration team released the final definition of the HSCT Technology Concept Airplane (TCA). This configuration represents the integration of current inputs from all technical disciplines into a realistic High Speed Civil Transport concept. This paper reviews the development and content of the high speed aerodynamics inputs to the TCA sizing and flight performance predictions. The paper also summarizes subsequent detailed analysis work, CFD, and TCA wind tunnel test data that are now being used to assess the drag levels of the "status" airplane (i.e. without projections). A bottoms-up assessment of the high speed drag technology projection is shown to identify reasonable sources of drag improvements that would meet the target levels. Sources of uncertainty in the current HSCT high speed drag predictions are outlined, and areas for risk reduction in future performance predictions are identified.
Author
Aerodynamic Drag; Aircraft Performance; Civil Aviation; Computational Fluid Dynamics; Supersonic Transports; Wind Tunnel Tests

20000046006 McDonnell-Douglas Corp., Long Beach, CA USA
Overview of MDC Configurations Aerodynamics Activities
Agrawal, Shreekant, McDonnell-Douglas Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 1-4; In English; See also 20000045988; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

This paper presents an outline of a general overview of MDC (McDonnell Douglas Corporation) Configuration Aerodynamics Activities in outline form. The topics are: 1) Nonlinear Rigid and Aeroelastic Analysis Methods; 2) Aerodynamic Design Optimization Capability; 3) Nacelle/Diverter Design and Airframe Integration; and 4) Technology Concept Assessment.
CASI
Aerodynamic Configurations; Aerodynamics; General Overviews

20000048284 Defence Science and Technology Organisation, Salisbury Australia
A Correlation Between Flight- Determined Longitudinal Derivatives and Ground-based Data for the Pilatus PC 9/A Training Aircraft in Cruise Configuration
Snowden, Andrew D.; Keating, Hilary A.; van Bronswijk, Nick; Drobik, Jan S.; Feb. 2000; 45p; In English
Report No.(s): AD-A376020; DSTO-TR-0937; DODA-AR-011-205; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of flight tests were conducted on the PC 9/A aircraft, A23-045 at the Royal Australian Air Force's Aircraft Research and Development Unit System identification techniques were applied to the data obtained from these flight tests to determine the stability and control derivatives of the aircraft. The longitudinal results for the aircraft in cruise configuration are presented in this report and comparisons are made with empirical and ground based estimates.
DTIC
System Identification; Derivation

20000048287 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Comparison of AEDC 4T and CALSPAN 8-ft Wing Tunnels for FA-18C/JDAM
Ray, E.; Jan. 13, 2000; 11p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AD-A376031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight test results for MK-84 Joint Direct Attack Munition (JDAM) separation from an F/A-18C allow for direct comparison between the Arnold Engineering Development Center 4 ft X 4 ft and CALSPAN 8 ft X 8 ft transonic wind tunnel data. Both freestream and Captive Trajectory System flow-field grid surveys were compared. Wind tunnel data tended to agree relatively well between wind tunnels. Wind tunnel data were input into the Navy Generalized Separation Package store separation simulation software. Comparisons were made between the flight paths derived from both wind tunnels to actual flight test data. Trajectory data were then used to calculate minimum miss distances between the JDAM and F-18. While it was expected that data

from the larger tunnel would result in simulations closer to flight testing, both data sets resulted in similar results. Most differences can be attributed to Mach number sensitivity.
DTIC
Wind Tunnel Tests; Product Development

20000048733 NASA Langley Research Center, Hampton, VA USA
1997 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 2, High Lift
Baize, Daniel G., Editor, NASA Langley Research Center, USA; December 1999; 796p; In English; Aerodynamic Performance, 25-28 Feb. 1997, Hampton, VA, USA; See also 20000048734 through 20000048753
Contract(s)/Grant(s): RTOP 537-07-00
Report No.(s): NASA/CP-1999-209691/VOL2; L-17916D/VOL2; NAS 1.55:209691/VOL2; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The High-Speed Research Program and NASA Langley Research Center sponsored the NASA High-Speed Research Program Aerodynamic Performance Workshop on February 25-28, 1997. The workshop was designed to bring together NASA and industry High-Speed Civil Transport (HSCT) Aerodynamic Performance technology development participants in areas of Configuration Aerodynamics (transonic and supersonic cruise drag, prediction and minimization), High-Lift, Flight Controls, Supersonic Laminar Flow Control, and Sonic Boom Prediction. The workshop objectives were to (1) report the progress and status of HSCT aerodynamic performance technology development; (2) disseminate this technology within the appropriate technical communities; and (3) promote synergy among the scientist and engineers working HSCT aerodynamics. In particular, single- and multi-point optimized HSCT configurations, HSCT high-lift system performance predictions, and HSCT Motion Simulator results were presented along with executives summaries for all the Aerodynamic Performance technology areas.
Author
Aerodynamic Characteristics; Aerodynamic Configurations; Civil Aviation; Performance Prediction; Supersonic Transports; Technology Utilization

20000048734 NASA Langley Research Center, Hampton, VA USA
HSR High Lift Program and PCD2 Update
Kemmerly, Guy T., NASA Langley Research Center, USA; Coen, Peter, NASA Langley Research Center, USA; Meredith, Paul, Boeing Commercial Airplane Co., USA; Clark, Roger, McDonnell-Douglas Aerospace, USA; Hahne, Dave, NASA Langley Research Center, USA; Smith, Brian, NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1693-1705; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The mission of High-Lift Technology is to develop technology allowing the design of practical high lift concepts for the High-Speed Civil Transport (HSCT) in order to: 1) operate safely and efficiently; and 2) reduce terminal control area and community noise. In fulfilling this mission, close and continuous coordination will be maintained with other High-Speed Research (HSR) technology elements in order to support optimization of the overall airplane (rather than just the high lift system).
Derived from text
Civil Aviation; Supersonic Transports; Lift; Wind Tunnel Tests; Computational Fluid Dynamics; Control Stability

20000048735 Boeing Commercial Airplane Co., Seattle, WA USA
Prediction of TCA Full Scale High Lift Characteristics
Meredith, Paul T., Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1707-1749; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The projected TCA L/D is reasonable but risky. TCA (Technology Concept Airplane) does not meet touchdown attitude requirements for a 155kt approach speed. L/D improvements may not show up as MTOW (Maximum Takeoff Weight) reductions since the TCA is sized with projected L/D. The status will approach the projection, risk & uncertainty will decrease, and the technology readiness level (TRL) will increase. Common High lift Process is mostly defined but not implemented.
Derived from text
Aerodynamic Characteristics; Full Scale Tests; Lift; Performance Prediction; Civil Aviation; Supersonic Transports

20000048736 NASA Langley Research Center, Hampton, VA USA

Use of Boundary Layer Transition Detection to Validate Full-Scale Flight Performance Predictions

Hamner, Marvine, McDonnell-Douglas Aerospace, USA; Owens, L. R., Jr., NASA Langley Research Center, USA; Wahls, R. A., NASA Langley Research Center, USA; Yeh, David, McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1751-1772; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Full-scale flight performance predictions can be made using CFD or a combination of CFD and analytical skin-friction predictions. However, no matter what method is used to obtain full-scale flight performance predictions knowledge of the boundary layer state is critical. The implementation of CFD codes solving the Navier-Stokes equations to obtain these predictions is still a time consuming, expensive process. In addition, to ultimately obtain accurate performance predictions the transition location must be fixed in the CFD model. An example, using the M2.4-7A geometry, of the change in Navier-Stokes solution with changes in transition and in turbulence model will be shown. Oil flow visualization using the M2.4-7A 4.0% scale model in the 14'x22' wind tunnel shows that fixing transition at 10% x/c in the CFD model best captures the flow physics of the wing flow field. A less costly method of obtaining full-scale performance predictions is the use of non-linear Euler codes or linear CFD codes, such as panel methods, combined with analytical skin-friction predictions. Again, knowledge of the boundary layer state is critical to the accurate determination of full-scale flight performance. Boundary layer transition detection has been performed at 0.3 and 0.9 Mach numbers over an extensive Reynolds number range using the 2.2% scale Reference H model in the NTF. A temperature sensitive paint system was used to determine the boundary layer state for these conditions. Data was obtained for three configurations: the baseline, undeflected flaps configuration; the transonic cruise configuration; and, the high-lift configuration. It was determined that at low Reynolds number conditions, in the 8 to 10 million Reynolds number range, the baseline configuration has extensive regions of laminar flow, in fact significantly more than analytical skin-friction methods predict. This configuration is fully turbulent at about 30 million Reynolds number for both 0.3 and 0.9, Mach numbers. Both the transonic cruise and the high-lift configurations were fully turbulent aft of the leading-edge flap hingeline at all Reynolds numbers.

Derived from text

Boundary Layer Transition; Computational Fluid Dynamics; Flight Characteristics; Performance Prediction; Wind Tunnel Models; Full Scale Tests

20000048737 ASE Technologies, Inc., Cincinnati, OH USA

Application of CFL3D to Aerodynamic Analysis of HSCT High Lift Wing/Body/Nacelle Configurations

Fan, Xue–Tong, ASE Technologies, Inc., USA; Hickey, Paul, ASE Technologies, Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1849-1882; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The first objective is to develop effective modeling procedures for CFD analysis of HSCT High Lift Wing/Body/Nacelle (WBN) configurations, develop multi-zone grid structure to include nacelle installation with and without deflected trailing edge flaps, and apply CFL3D to these complex wing/body/nacelle configurations using RONNIE preprocessor for block interfacing. The second is to evaluate the effect of nacelle installation on the aerodynamic performance of HSCT High Lift configurations, identify and analyze important flow characteristics due to nacelle installation to support Propulsion Airframe Integration, and to provide flow and performance data to supplement wind tunnel tests.

Derived from text

Aerodynamic Characteristics; Aerodynamic Configurations; Computational Fluid Dynamics; Wind Tunnel Tests; Nacelles; Applications Programs (Computers); Supersonic Transports; Body-Wing Configurations

20000048738 Boeing North American, Inc., Seal Beach, CA USA

CLF3D/MAGGIE CFD Analysis of a 4%-Scale HSCT Aircraft Model Inside a 12-ft Wind Tunnel

Woan, Chung–Jin, Boeing North American, Inc., USA; Yeh, David T., McDonnell-Douglas Aerospace, USA; Clark, Roger W., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1883-1931; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objectives of this study are: 1) to develop an integrated wind-tunnel/free-air CFD process to speed up CFD turnaround time in HSCT high-lift configuration development through a direct CFD application to the M2.4-7A Arrow Wing configuration at low speed; 2) to study the effects of wind-tunnel wall on the model aerodynamic characteristics and the combined effects due to the wind4unnel wall and model supports through direct comparison of CFD calculations; and 3) to obtain CFD results prior to wind-tunnel tests and to validate and evaluate the CFD results by direct comparison with wind-tunnel test data. Currently,

M2.4-7A is still under schedule to be wind-tunnel tested in the NASA/Ames 12-ft tunnel. Therefore, the validation of CFD results against test data will not be included in this paper.
Derived from text
Aerodynamic Characteristics; Aerodynamic Configurations; Aircraft Models; Computational Fluid Dynamics; Wind Tunnel Tests; Wind Tunnel Walls; Preprocessing

20000048739 NASA Langley Research Center, Hampton, VA USA
Results of a WINGDES2/AERO2S Flap Optimization for the TCA
Yaros, Steven F., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1933-1946; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The codes WINGDES2 and AERO2S were easy to obtain, and technical help was readily available. The codes have a long, well-documented history of successful optimizations of various aircraft configurations. The codes were easy to use, although specification of input data was time-consuming. The Run times were short, allowing the many runs necessary for the Suction Parameter matrix to be accomplished within a day or two. The results of the optimization appear to be reasonable.
Derived from text
Optimization; Flaps (Control Surfaces); Aircraft Configurations; Applications Programs (Computers); Civil Aviation

20000048740 Vigyan Research Associates, Inc., Hampton, VA USA
Flow Simulation About a High-Lift High Speed Civil Transport Using TetrUSS
Lessard, Victor, Vigyan Research Associates, Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1947-1974; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

TetrUSS unstructured grid generation for both Euler and viscous calculations of high-lift HSR configurations is both fast and straight forward. The flap effectiveness study shows the potential of using unstructured Euler calculations as a part of the preliminary design process. USM3D viscous calculations on the baseline TCA configuration compared well with the limited experimental data. USM3D has the potential of handling complex viscous flow fields.
Derived from text
Civil Aviation; Supersonic Transports; Viscous Flow; Computerized Simulation; Aerodynamic Configurations; Applications Programs (Computers); Lift

20000048741 NASA Langley Research Center, Hampton, VA USA
A CFD Assessment of Several High-Lift Reference H Configuration Using Structured Grids
Lessard, Wendy B., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1975-2001; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objective of this study is to calibrate a Navier-Stokes code for a high-lift Reference H configuration using structured grids. The outline of this presentation will first include a brief description of the grids used and the flow solver. Next the results will be presented in terms of convergence and resources used on the C-90. Predicted force and moment and surface pressure results are compared to experiment and off- and on-surface flow viz. is discussed.
Derived from text
Computational Fluid Dynamics; Structured Grids (Mathematics); Lift; Navier-Stokes Equation; Nacelles; Body-Wing and Tail Configurations

20000048742 Boeing Commercial Airplane Co., Seattle, WA USA
Assessment and Application of CFD Methods for HSCT High-Lift Aerodynamics
Chen, Allen, Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2003-2075; In English; See also 20000048733; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This paper presents an Assessment and Application of CFD Methods For HSCT High-Lift Aerodynamics. The topics discussed are: 1) Review of CFD (Computational Fluid Dynamics Codes; 2) Overview of CFD Activities; 3) The Process; 4) Results; and 5) Issues. This paper is presented in viewgraph form.
CASI
Civil Aviation; Computational Fluid Dynamics; Supersonic Transports; Lift; Applications Programs (Computers)

20000048743 Boeing Commercial Airplane Co., Seattle, WA USA

Recent High Lift Systems and Alternate Control Test Results

Wyatt, G. H., Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2077-2104; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

High lift performance continues to be critical to the HSR program. Currently the baseline TCA is sized to Stage III -3db at cutback. A more aggressive noise goal of Stage III -5db will make achieving the technology projection for L/D at cutback more critical. Lift at takeoff and touchdown will be reduced when the new common process is finished. The use of wind tunnel data instead of AERO2S will reduce lift levels. This will also make the TOFL and VAPP constraints more critical. As the literature suggests dynamic ground effect may be as little as 1/2 of static ground effect. We currently are using static ground effect. If dynamic ground effect considerations are required, then lift will be even more critical to mission sizing. High lift systems on canards will need to be worked harder to get the desired lift with minimum drag. The simple attempt to improve the high AR canard with dowels and clax did not work. We have to do our homework in this area to produce an efficient highly loaded canard. The basic wing produces lots of induced drag with lift, by reducing wing lift and carrying the lift reduction from the wing on a high AR canard with better induced drag characteristics leads to a more efficient system. A high mount canard may provide up to 0.5 units improvement in trimmed L/D, this benefit seems to diminish as the canard is mounted longitudinally closer to the wing.
Derived from text

Lift; Canard Configurations; Wind Tunnel Tests; Longitudinal Control; Helicopter Performance

20000048744 Lockheed Martin Aeronautical Systems, Marietta, GA USA

An Approach to Modeling HSR Configurations With Control Surface Deflections

Kinard, Tom, Lockheed Martin Aeronautical Systems, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2105-2153; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The overall objective of this work is to evaluate state-of-the-art CFD methods for application to high speed research configurations. The tools will be evaluated as to their ability to produce good flow field predictions for use in preliminary and detailed design studies. The current focus of the work is on high lift configurations of the Reference H aircraft. Particular attention is placed on the ability of structured grid methods to predict the flow field around wings with deflected flaps. The objective of the first study presented here is to assess the ability of the CFL3D code to predict the forces and moments due to multiple trailing edge flap deflections. The objective of the second or ground effect study is to evaluate the current state-of-the-art in predicting aerodynamic characteristics of a HSR configuration operating in close proximity of the ground. An exhaustive examination of this topic is beyond the scope of current funding, therefore a limited study involving only a few configurations has been undertaken.
Derived from text

Control Surfaces; Deflection; Supersonic Transports; Aerodynamic Configurations; Computational Fluid Dynamics; Scale Models; Aerodynamic Characteristics

20000048745 McDonnell-Douglas Aerospace, Long Beach, CA USA

Automated Flap Deflection Procedures for HSCT High-Lift Aerodynamics

Yeh, David T., McDonnell-Douglas Aerospace, USA; Clark, Roger W., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2155-2229; In English; See also 20000048733; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This report starts with the statement of the objective for the HSCT high-lift aerodynamics, followed by the description of the need for automatic flap modeling procedures for high-lift applications. The flap layout and arrangement for HSCT high-lift configurations are described. The detailed methodologies and gridding techniques incorporated in the flap deflection procedures are discussed. The numerical capability of the flap procedures is demonstrated for a number of HSCT high-lift configurations. Sample solutions and code validation are presented followed by a summary.
Derived from text

Aerodynamic Configurations; Civil Aviation; Deflection; Flapping; Supersonic Transports; Lift

20000048746 Boeing Co., Seattle, WA USA

A New Approach to Constrained Induced and Trim Drag Optimization

Feifel, Winifried M., Boeing Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2231-2256; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A new numerical method has been developed which allows the easy construction of a complete induced drag and pitch trim model for fully three-dimensional aircraft configurations comprised of an arbitrary number of lifting surfaces. The induced drag is described as a function of a small number of parameters, such as lift, canard, wing, and tail incidence angles, and the deflection angles of trailing edge flaps. Combined with constrained optimization the method allows optimal trim of multi-surface configurations with minimum computational effort on a PC. Ref.H tmfling edge flap positions have been experimentally optimized -tail off- as part of the NASA437 test series conducted in the NASA Langley 14x22 wind tunnel. Generally, the untrimmed 'optimum' configurations exhibited large pitching moments. The above described method accepts experimentally acquired data as constraints and thus can be used to determine trimmed model performance characteristics. The analyses indicate that the trimmed optimum performance greatly depends on the type of trim surfaces used. At the lift coefficients of interest a canard configuration exhibits DELTAL/D=0.7 higher lift/drag ratio than the conventional tail configuration. Only about 1/3 of the canard performance gain is shown to be the result of savings in induced drag. The balance of the gain is attributed to changes in wing viscous drag. Compared to the conventional tail configuration the performance of the canard is shown to be less sensitive to migration of the airplane center of gravity. Only small further performance improvements seem to become available from a tri-surface configuration.
Derived from text
Aerodynamic Balance; Aircraft Configurations; Induced Drag; Optimization; Wind Tunnel Tests; Applications Programs (Computers); Three Dimensional Models; Computational Fluid Dynamics

20000048747 NASA Ames Research Center, Moffett Field, CA USA
High-Lift Engine Aeroacoustics Technology (HEAT) Test Program Overview
Zuniga, Fanny A., NASA Ames Research Center, USA; Smith, Brian E., NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2257-2276; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The NASA High-Speed Research program developed the High-Lift Engine Aeroacoustics Technology (HEAT) program to demonstrate satisfactory interaction between the jet noise suppressor and high-lift system of a High-Speed Civil Transport (HSCT) configuration at takeoff, climb, approach and landing conditions. One scheme for reducing jet exhaust noise generated by an HSCT is the use of a mixer-ejector system which would entrain large quantities of ambient air into the nozzle exhaust flow through secondary inlets in order to cool and slow the jet exhaust before it exits the nozzle. The effectiveness of such a noise suppression device must be evaluated in the presence of an HSCT wing high-lift system before definitive assessments can be made concerning its acoustic performance. In addition, these noise suppressors must provide the required acoustic attenuation while not degrading the thrust efficiency of the propulsion system or the aerodynamic performance of the high-lift devices on the wing. Therefore, the main objective of the HEAT program is to demonstrate these technologies and understand their interactions on a large-scale HSCT model. The HEAT program is a collaborative effort between NASA-Ames, Boeing Commercial Airplane Group, Douglas Aircraft Corp., Lockheed-Georgia, General Electric and NASA - Lewis. The suppressor nozzles used in the tests were Generation 1 2-D mixer-ejector nozzles made by General Electric. The model used was a 13.5%-scale semi-span model of a Boeing Reference H configuration.
Derived from text
Aeroacoustics; Civil Aviation; Engine Tests; Supersonic Transports; Wind Tunnel Tests; Lift; Nozzle Geometry; Scale Models

20000048748 DYNACS Engineering Co., Inc., Renton, WA USA
Numerical Study of the Reynolds Number Effect and Boundary Layer Transition Location Effect
Saladino, Anthony J., DYNACS Engineering Co., Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2277-2354; In English; See also 20000048733; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This presentation summarizes the effects of Reynolds number and boundary layer transition between wind tunnel data and CFD solutions. Computations for a Ref. H wing/body configuration with flaps deflected LE 30 degrees/outboard TE 20 degrees were analyzed for two Reynolds numbers and one trip location. This study will focus on a single Mach number, angle of attack and flap setting to assess the predictive capabilities of CFD. Results are shown for Mach 0.3 and alpha 10 degrees. The first part of this study evaluated the TNS3DMB CFD code for capturing the influence of Reynolds number variations. Wind tunnel measurements were made in the NTF at chord Reynolds numbers of 30 million and 90 million. Pressure data from NTF test 057 at various spanwise and chordwise stations are compared with CFD; aerodynamic coefficient data from NTF test 060 are compared with CFD. Based upon the results from the Reynolds number study, it was concluded that there was a need to understand the influence of boundary layer transition effects on the aerodynamic coefficients. Data from NTF test 080 was used to compare with TNS3DMB at a chord Reynolds number of 21.6 million. Comparisons were made with NTF tests without and with trips,

and with CFD runs at fully turbulent conditions and with the wing tripped at the leading edge hinge line. Additional results obtained from CFD include surface plots of pressure coefficient, Y (exp +), C (sub f), and velocity vectors.
Derived from text
Boundary Layer Transition; Computational Fluid Dynamics; Reynolds Number; Wind Tunnel Tests; Flapping; Body-Wing Configurations

20000048749 NASA Langley Research Center, Hampton, VA USA
Testing the 2.2% HSR Reference H Model with a Modified Wing Planform in the NTF
Owens, Lewis R., Jr., NASA Langley Research Center, USA; Wahls, Richard A., NASA Langley Research Center, USA; Hamner, Marvine P., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2355-2384; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The HSR program moved into phase two with the selection of a new airplane configuration, the Technology Concept Airplane (TCA). The TCA was designed based on the experiences gained while investigating both the Reference H and the Arrow Wing configurations in different wind tunnels and CFD studies. Part of that investigation included performing extensive high Reynolds number testing on the Reference H configuration in the NTF to provide data for predicting full-scale flight performance, as well as developing techniques for testing these types of configurations in the NTF. With the selection of the TCA configuration, a smaller investigation was designed to examine whether or not the scaling characteristics of the TCA configuration are similar to those observed for the Reference H configuration. This presentation will include a description of the 2.2% Modified Reference H model used in this investigation (highlighting the similarities and the differences when compared to the TCA configuration), the testing objectives, and some preliminary findings that are relevant to the current high-lift system.
Derived from text
Aerodynamic Configurations; Computational Fluid Dynamics; Wing Planforms; Wind Tunnel Tests; Test Facilities

20000048751 Boeing Commercial Airplane Co., Seattle, WA USA
Status of NASA No. 442 Test Results: 6% Ref. H Upflow and Interference Test in the LaRC 14-ft x 22-ft
Griffiths, Robert C., Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2409-2429; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The purpose of this Test #442 was to test Ref. H model configurations in such a manner that 14'x22' upflow and post mount support interference could be determined. Comparisons of experimentally derived interference data will be compared to computationally calculated support interference. The results of this test will support an HSR contract deliverable.
Derived from text
Wind Tunnel Tests; Flow Visualization; Support Interference; Aerodynamic Configurations; Subsonic Wind Tunnels

20000048752 McDonnell-Douglas Aerospace, Long Beach, CA USA
Application of a 3-D Panel Method to the Prediction of Wind Tunnel Wall and Support Interference
Polito, Ryan C., McDonnell-Douglas Aerospace, USA; Powell, Arthur G., McDonnell-Douglas Aerospace, USA; Clark, Roger W., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2431-2459; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objective of this study is to evaluate the prediction of wind tunnel wall and support effects using a 3-D panel method. The results presented here are based on the 6% Ref H model installed in the NASA LaRC 14'x22' wind tunnel. However, the modeling developed will be used for the correction of data to be obtained for the TCA configuration in both the LARC 14'x22' tunnel as well as in the ARC 12' Pressure Tunnel. Since the data from the 6% Ref H test has only recently been released, this effort is still in progress. The results presented here are therefore regarded as preliminary.
Derived from text
Aerodynamic Interference; Panel Method (Fluid Dynamics); Wind Tunnel Walls; Wind Tunnel Tests; Three Dimensional Flow; Aerodynamic Configurations; Performance Prediction

20000048753 McDonnell-Douglas Aerospace, Long Beach, CA USA
Assessment of Computational Methods Applied to HSCT High-Lift Configurations with Multiple Flap Surfaces
Yeh, David, McDonnell-Douglas Aerospace, USA; Clark, Roger W., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 1773-1847; In English;

See also 20000048733; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This report starts with the description of the objective for the HSCT high-lift aerodynamics, followed by the numerical approach. The automated flap deflection procedures used for high-lift applications will be briefly described. The numerical results for the high-lift configurations will be presented including code validation, predicted flow physics as well as the discussion of the numerical issues that affect the flow solutions. This report concludes with a summary and future plans.

Derived from text

Aerodynamic Configurations; Civil Aviation; Supersonic Transports; Lift; Computational Fluid Dynamics; Technology Assessment; Flaps (Control Surfaces)

20000050476 Army Research Lab., Hampton, VA USA

Contributions of the Langley Transonic Dynamics Tunnel to Rotorcraft Technology and Development

Yeager, William T., Jr., Army Research Lab., USA; Kvaternik, Raymond G., NASA Langley Research Center, USA; [2000]; 60p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1771; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A historical account of the contributions of the Langley Transonic Dynamics Tunnel (TDT) to rotorcraft technology and development tunnel's inception in 1960 is presented. The paper begins with a summary of the major characteristics of the TDT and a description of the unique capability offered by the TDT for testing aeroelastic models by virtue of its heavy gas test medium. This is followed by some remarks on the role played by scale models in the design and development of rotorcraft vehicles and review of the basic scaling relationships important for designing and building dynamic aeroelastic models of rotorcraft vehicles for testing in the TDT. Chronological accounts of helicopter and tiltrotor research conducted in the TDT are then described in separate sections. The discussions include a description of the various models employed, the specific objectives of the tests, and illustrative results.

Author

Rotary Wing Aircraft; Transonic Wind Tunnels; Scale Models; Aeroelasticity; Turbofan Engines; Histories

20000052206 NASA Dryden Flight Research Center, Edwards, CA USA

Longitudinal Handling Qualities of the TU-144LL Airplane and Comparisons With Other Large, Supersonic Aircraft

Cox, Timothy H., NASA Dryden Flight Research Center, USA; Marshall, Alisa, NASA Dryden Flight Research Center, USA; May 2000; 44p; In English

Contract(s)/Grant(s): RTOP 529-50-24-E8-RC

Report No.(s): NASA/TM-2000-209020; H-2401; NAS 1.15:209020; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Four flights have been conducted using the TU-144LL supersonic transport aircraft with the dedicated objective of collecting quantitative data and qualitative pilot comments. These data are compared with the following longitudinal flying qualities criteria: Neal-Smith, short-period damping, time delay, control anticipation parameter, phase delay (omega(sp)*T(theta(2))), pitch bandwidth as a function of time delay, and flight path as a function of pitch bandwidth. Determining the applicability of these criteria and gaining insight into the flying qualities of a large, supersonic aircraft are attempted. Where appropriate, YF-12, XB-70, and SR-71 pilot ratings are compared with the TU-144LL results to aid in the interpretation of the TU-144LL data and to gain insight into the application of criteria. The data show that approach and landing requirements appear to be applicable to the precision flightpath control required for up-and-away flight of large, supersonic aircraft. The Neal-Smith, control anticipation parameter, and pitch-bandwidth criteria tend to correlate with the pilot comments better than the phase delay criterion, omega(sp)*T(theta(2)). The data indicate that the detrimental flying qualities implication of decoupled pitch-attitude and flightpath responses occurring for high-speed flight may be mitigated by requiring the pilot to close the loop on flightpath or vertical speed.

Author

Supersonic Aircraft; TU-144 Aircraft; Flight Characteristics; Data Acquisition; Controllability; Bandwidth; Pilot Ratings; Aircraft Performance

20000052483 NASA Glenn Research Center, Cleveland, OH USA

On Flowfield Periodicity in the NASA Transonic Flutter Cascade, Part 1, Experimental Study

Lepicovsky, J., DYNACS Engineering Co., Inc., USA; McFarland, E. R., NASA Glenn Research Center, USA; Chima, R. V., NASA Glenn Research Center, USA; Wood, J. R., NASA Glenn Research Center, USA; March 2000; 16p; In English; 45th; International Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany; Sponsored by American

Society of Mechanical Engineers, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-98008; RTOP 523-26-13
Report No.(s): NASA/TM-2000-209934/PT1; E-12179/PT1; NAS 1.15:209934/PT1; ASME-2000-GT-0572-Pt-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An extensive study to improve flow uniformity and periodicity in the NASA Transonic Flutter Cascade is presented here. The results are reported in two independent parts dealing with the experimental approach and the analytical approach. The first part, the Experimental Study, focuses first on the data sets acquired in this facility in the past and explains several discrepancies, particularly the questions of actual flow incidence and cascade back pressure levels. Next, available means for control and modifications of the cascade flowfield, boundary layer bleed and tailboard settings are presented in detail. This is followed by experimental data sets acquired in modified test facility configurations that were based on analytical predictions of the cascade flowfield. Finally, several important conclusions about improving the cascade flowfield uniformity and blade load periodicity are summarized. The important conclusions are: (1) boundary layer bleed does not improve the cascade flow periodicity; (2) tunnel wall contours must be carefully matched to the expected shape of cascade streamlines; (3) actual flow incidence for each cascade configuration rather must be measured instead of relying on the tunnel geometry; and (4) the current cascade configuration exhibits a very high blade load uniformity over six blades from blade #2 to blade #7, and the facility is now ready for unsteady pressure data acquisition.
Author
Boundary Layers; Cascade Flow; Data Acquisition; Prediction Analysis Techniques; Transonic Flutter

20000053023 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
VSTOL Ground Effects Characterization and Control
Polsky, Susan A.; Jan. 2000; 2p; In English
Report No.(s): AD-A375807; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Develop and validate a numerical method using computational fluid dynamics (CFD) for the prediction of VSTOL ground effects flow fields. Use the validated computational prediction method to explore flow control devices designed to limit lift loss due to suckdown and hot gas ingestion and to limit landing area heating and acoustic level.
DTIC
V/STOL Aircraft; Ground Effect (Aerodynamics); Computational Fluid Dynamics; Prediction Analysis Techniques; Flow Distribution

20000054797 Kohlman Systems Research, Inc., Lawrence, KS USA
Predictive Models for Aerial Refueling Simulations
Svoboda, Charlie, Kohlman Systems Research, Inc., USA; Ryan, George Wesley, III, Kohlman Systems Research, Inc., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 21.1 - 21.9; In English; See also 20000054782; Copyright; Avail: Issuing Activity

A flight test program was completed for two tanker and five receiver aircraft by Kohlman Systems Research and SIMTEC, Inc. to improve the existing USA Air Force Air Mobility Command aerial refueling training devices. The Tankers included a Boeing KC135R and a Douglas KC-10A. The receivers included a Lockheed C- 14 1 B and C-5B, a Douglas C- 17A and KC10A, and a Boeing KC-135R. These tests recorded quantitative measurements of the aerodynamic changes and random turbulence acting on both the tanker and receiver during refueling. This paper presents a predictive estimation of the aerial refueling effects of a Douglas KC-10A tanker on a Boeing E-3A receiver. These effects are explained as a result of the tanker downwash acting on the receiver. This paper focuses on the predictive modeling of the receiver coefficient trim A's and does not deal with the modeling of receiver turbulence or tanker coefficient trim Delta's.
Author
Air to Air Refueling; Flight Tests; Prediction Analysis Techniques; Simulation; Tanker Aircraft; Training Devices

20000056092 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA
Measurements in a Transitional Boundary Layer Under Low-Pressure Turbine Airfoil Conditions *Final Report*
Simon, Terrence W., Minnesota Univ., USA; Qiu, Songgang, Minnesota Univ., USA; Yuan, Kebiao, Minnesota Univ., USA; March 2000; 220p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-1249; RTOP 522-31-23
Report No.(s): NASA/CR-2000-209957; E-12215; NAS 1.26:209957; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report presents the results of an experimental study of transition from laminar to turbulent flow in boundary layers or in shear layers over separation zones on a convex-curved surface which simulates the suction surface of a low-pressure turbine airfoil. Flows with various free-stream turbulence intensity (FSTI) values (0.5%, 2.5% and 10%), and various Reynolds numbers (50,000, 100,000 200,000 and 300,000) are investigated. Reynold numbers in the present study are based on suction surface length and passage exit mean velocity. Flow separation followed by transition within the separated flow region is observed for the lower-Re cases at each of the FSTI levels. At the highest Reynolds numbers and at elevated FSn, transition of the attached boundary layer begins before separation, and the separation zone is small. Transition proceeds in the shear layer over the separation bubble. For both the transitional boundary layer and the transitional shear layer, mean velocity, turbulence intensity and intermittency (the fraction of the time the flow is turbulent) distributions are presented. The present data are compared to published distribution models for bypass transition, intermittency distribution through transition, transition start position, and transition length. A model developed for transition of separated flows is shown to adequately predict the location of the beginning of transition, for these cases, and a model developed for transitional boundary layer flows seems to adequately predict the path of intermittency through transition when the transition start and end are known. These results are useful for the design of low-pressure turbine stages which are known to operate under conditions replicated by these tests.
Author
Airfoils; Boundary Layer Separation; Low Pressure; Transition Flow; Turbines; Wind Tunnel Tests

20000056199 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
MSC/NASTRAN Static Aeroelastic Analysis Using the MDO FE-Model
Rollema, G. J.; Feb. 1999; 130p; In English
Report No.(s): PB2000-103706; No Copyright; Avail: National Technical Information Service (NTIS)

This M.Sc. thesis built upon the 'Multi-Disciplinary Design, Analysis and Optimization of Aerospace Vehicles Project (MDO-project)'. The main objectives of the thesis were to use MSC/NASTRAN to perform static aeroelastic analysis on a FE-model of an aircraft and to create facilities within the MDO-software capable of handling the results from theses analysis. The FE-model used for the static aeroelastic analysis was generated by the MDO-software. This FE-model incorporated a simple aerodynamic model representing wing and tailplane. The MDO-software does not generate the fuselage aerodynamic model so this was added manually. The results from the static aeroelastic analysis consisted of aerodynamic pressures, forces, and moments acting on the aerodynamic models during specific flight conditions. These results are written to a special output file by MSC/NASTRAN.
NTIS
Aeroelasticity; Design Analysis; Aircraft Design

20000056860 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands
2D Maximum Lift Prediction of a Three Element Airfoil
deCock, K. M. J.; Sep. 1998; 30p; In English; Symposium on Computational and Experimental Methods in Mechanical and Thermal Engineering, Ghent, Belgium, May 7-8, 1998. Sponsored by Nederlands Inst. voor Vliegtuigontwikkeling en Ruimtevaart, Delft
Report No.(s): PB2000-104884; NLR-TP-98235; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the paper the 2D maximum lift prediction capability of an unstructured Reynolds-Averaged Navier-Stokes (RANS) CFD method is evaluated. The Fully Automatic Navier-Stokes (FANS) method is briefly described. 2D maximum lift for a three element airfoil is predicted and compared with experiments, for both take-off and landing. The conclusion of this evaluation is that the present RANS CFD method, based on the kappa-omega turbulence model, gives an adequate predictive capability of maximum lift for the take-off configuration, including a significant confluence between slat wake and wing boundary layer. For the landing configuration, the CFD method predicts the shape of the lift curve and angle of attack at maximum lift. The deficiency in the maximum lift prediction for the landing configuration is due to the absence of an extra rate-of-strain term in the kappa-omega turbulence model.
NTIS
Two Dimensional Models; Mathematical Models; Airfoils; Lift; Aerodynamic Configurations; Performance Prediction

20000057220 NASA Ames Research Center, Moffett Field, CA USA
Viscous Analysis of Ref. H Based Wing/Bodies
Lawrence, Scott L., NASA Ames Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 335-353; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Computations have been performed on the baseline Reference H wing/body configuration, as well as the Wing 704 configuration, an optimized wing and fuselage combination derived from Ref. H through automated optimization. The parabolized Navier-Stokes solver UPS was employed with viscous terms in two directions in an effort to understand the source and level of potential viscous/inviscid interactions. The paper briefly describes the UPS code and the grids used to obtain the solutions before the discussion of results. Results of these computations indicate that viscous/inviscid interaction can contribute increments to both the pressure- and friction-related drag. Computations were performed for wind tunnel conditions-1.675% scale models at a Reynolds number of 4 million per foot. Turbulent flow results were obtained using the Baldwin-Lomax algebraic turbulence model and were compared with laminar flow results. The laminar flow fields were used to obtain upper bounds on potential interaction effects.

Author

Viscous Flow; Applications Programs (Computers); Body-Wing Configurations; Aerodynamic Drag; Interactions; Inviscid Flow; Flow Characteristics

20000057221 McDonnell-Douglas Aerospace, Long Beach, CA USA

CFD Code Validation for HSCT Wing/Body and Wing/Body/Nacelle/Diverter Configurations

Hager, James O., McDonnell-Douglas Aerospace, USA; Kuruvila, Geojoe, McDonnell-Douglas Aerospace, USA; Cheung, Samson H., McDonnell-Douglas Aerospace, USA; Unger, Eric R., McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 355-393; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The purpose of this study was to evaluate and/or validate CFD predictions of HSCT configurations. This was done in order to recommend analysis codes for HSCT analysis and design. This study can be divided into two parts: supersonic calculations, and transonic calculations. The supersonic calculations focused on predicting the supersonic cruise performance of wing/body (W/B) and wing/body/nacelle/diverter (W/B/N/D) configurations. The CFD predictions were compared to the 2.7% Ref. H tests in the Ames 9' x 7' wind-tunnel. It was demonstrated that both TLNS3D and CFL3D in the Navier-Stokes (N-S) mode (Baldwin-Lomax) can accurately predict the W/B cruise-point drag. CFL3D in the N-S mode (Baldwin-Lomax) can accurately predict the W/B/N/D cruise-point drag. AIRPLANE and CFL3D in the Euler mode did not accurately predict the local flow features. The transonic calculations focused on predicting Reynolds-number effects and off-design performance for wing/body and wing/body/flaps (W/B/F) configurations. The CFD predictions were compared to the 2.2% Ref. H tests in the Langley NTF wind-tunnel and the 1.675% Ref. H tests in the Langley 16' transonic (16T) wind-tunnel. TLNS3D and CFL3D, using the Baldwin-Lomax turbulence model, predicted the Reynolds-number effect on drag reasonably well. It was also shown that the pressure drag is essentially independent of the Reynolds number for Re(sub c) greater than 30 million for the W/B and W/B/F configurations. CFL3D, with the Baldwin-Lomax or Baldwin-Barth turbulence models, was able to predict the off-design performance reasonably well.

Author

Computational Fluid Dynamics; Navier-Stokes Equation; Pressure Drag; Program Verification (Computers); Applications Programs (Computers); Aerodynamic Configurations

20000057222 Boeing Co., Seattle, WA USA

Overview of HSR Aerodynamic Optimization at Boeing

Conner, R. S., Boeing Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 395-421; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation provides an overview of the Boeing HSR-AT work on point design, nonlinear aerodynamic optimization of the baseline HSR configuration, Reference H. The efforts can be described as a building block approach, designed to develop the capability for and to evaluate the potential improvement of individual components. These pieces are then combined into increasingly larger problems, moving toward the ultimate goal of simultaneous optimization of the complete configuration. In addition to treating individual components, individual classes of variables are also investigated in isolation. The building block approach is further guided by a goal to evaluate potential differences between the linear Preliminary Design (PD) methods and nonlinear optimization, thereby providing feedback to improve the PD process. The tool used, TRANAIR, is briefly described with an emphasis on those characteristics which are at the heart of the optimization and/or impact the process of application. This is then followed by a general description of the overall process of application and an introduction to the generic optimization problem that is solved. This work is a continuation of last year's HSR optimization efforts. The emphasis for this year has been in areas which were either neglected before or revealed by the previous work to be in need of improvement. The first is the incorporation of all relevant and reasonably possible program constraints. This was a major extension of the method. Another area

is improvement of the accounting for unfavorable viscous effects. The other major areas are an improvement to the inherent smoothness of the resulting optimizations and an improvement of the resolution of the tool by reducing the aerodynamic variability. This overview concludes with some engineering analysis of calculations of previous optimizations. Comparisons of full potential and Euler solutions are shown along with examples of suggested physical mechanisms associated with drag reduction.
Author
Design Analysis; Optimization; Aircraft Design; Aerodynamic Configurations; Applications Programs (Computers)

20000057223 McDonnell-Douglas Aerospace, Long Beach, CA USA
Some Recent Enhancements to Aerodynamic Shape Optimization Methods at McDonnell Douglas Aerospace
Hartwich, Peter M., McDonnell-Douglas Aerospace, USA; Unger, Eric R., McDonnell-Douglas Aerospace, USA; Arslan, Alan E., McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 423-443; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A High-Speed Civil Transport (HSCT) aircraft has to simultaneously satisfy a multitude of often conflicting constraints and to meet rather stringent aerodynamic performance requirements across a wide speed range extending from high-lift, over transonic to supersonic cruise conditions. Extensive use of nonlinear optimization techniques is presently considered the most promising way of satisfying all of these requirements. The technical activities highlighted in this paper are aimed at enhancing the nonlinear aerodynamic design optimization capabilities at McDonnell Douglas. The topics discussed pertain to three areas: alternate sensitivity analysis methods for use with gradient-based optimization methods, a grid perturbation scheme for the rapid adjustment of computational multiblock patched grids over complex configuration during aerodynamic optimization processes, and an alternate approach toward the parametrization of 3-D geometries for use in aerodynamic shape optimization. The methods employed in each area are outlined, and some illustrative results are included to highlight accomplishments as well as future challenges.
Author
Aerodynamic Configurations; Computational Grids; Design Analysis; Optimization; Conjugate Gradient Method; Aircraft Design

20000057224 Boeing Co., Seattle, WA USA
Boeing HSR Wing Optimization Using Tranair
Wittenberg, K. R., Boeing Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 445-492; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation provides a review of the HSR-AT study of point design, non-linear aerodynamic wing optimization of the baseline HSR configuration, Reference H. Evaluations were made at cruise Mach and C(sub L). A building block approach was used to develop a robust optimization method using Tranair. The individual components implemented and tested this year include project, optimization, and flow constraints. Tranair optimization runs consider nearly 30,000 constraints, with over 200 wing variables in a specified grid. The project wing constraints include leading edge, spanwise and chordwise curvatures, thickness at the spars and main landing gear bay, vertical placement relative to the floor, diverter leading and trailing edge heights, and twist axis along a spar. The extensive project constraints improve geometry validity during optimization. The optimization constraints have been implemented for solution convergence and include transpiration, delta Mach, and spanwise curvature. Mach level limits were imposed as the only flow constraint. Much effort was expended to find consistent methods to converge these large optimizations successfully. As new capability was developed, it was systematically added to previously verified methods. This building block approach allowed determination of thickness only effect, camber and twist effect, and finally thickness with camber and twist.
Author
Optimization; Aircraft Design; Wing Profiles; Applications Programs (Computers); Design Analysis

20000057225 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Advances in Design Optimization Using Adjoint Methods
Reuther, James, Research Inst. for Advanced Computer Science, USA; Saunders, David, Sterling Software, Inc., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 493-527; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation outlines the progress made at Ames Research Center in the past 6 months with CFD-based aerodynamic shape optimization software tools, in particular with their adaptation to the High Speed Research program. Given an efficient and robust flow solver, the key to optimization efficiency is the calculation of gradient information cheaply by means of an adjoint solver combined with a fast and reliable grid regeneration capability. The two main topics to be covered are the enhancements made to the single-block adjoint-based wing/body design code SYN87, and the recent development of the multiblock adjoint-based code SYN87, which is also parallelized. While these programs (particularly SYN87) have been adapted considerably at Ames for HSR purposes, the initial development has been for general purpose aerodynamic optimization by Professor Antony Jameson (Princeton) and James Reuther (RIACS). Implementation of the multiblock code has also been contributed to significantly by other collaborators at Princeton and Brigham Young Universities. Even though the single-block SYN87 is limited to the Euler-based design of wings or wing/bodies, its ability to provide rapid results by virtue of its built-in grid generation means it should remain a work-horse even as the more general multiblock code becomes established. Thus further enhancements are still warranted. Moreover, SYN87's pseudo-nacelle option (a highly HSR-specific adaptation) provides a means of approximating the effects of under-wing nacelle/diverters. Valid for supersonic applications only, this option imposes delta Cps from external nacelles-on/nacelles-off calculations, which may need updating more than once as the overall design proceeds. The versatility and applicability of SYN87 to problems outside the HSR program are demonstrated by its application to the wing design of a transonic business jet. For this problem, the effects of an aft-mounted nacelle were simulated by means of a large fuselage bump determined by a preliminary optimization with appropriate target wing pressures, then frozen during the wing design. Thus the single-block code is not as limited as the grid topology suggests, but there certainly remains room for improvement. The multiblock design code needs an initial point-to-point-matching multiblock grid prepared ahead of time, and is thus inherently more labor-intensive to use. But it significantly expands the complexity of the configurations which can be handled accurately. SYN87-MB has been implemented with parallelization in mind from the start. The parallelism is at the medium-grain level provided naturally by the grid blocks or groups of blocks. Furthermore, it is portable to any system supporting MPI (standardized Message Passing Interface). Actually, specifying a single processor at the user level allows the same code to run on systems without MPI. Both SYN87 and SYN87-MB provide for optimization with either finite difference gradients or adjoint-based gradients, for a range of likely objective functions with no application-specific programming required. In the following discussion, the advantages of the adjoint approach will be summarized, the theory will be outlined, and gradient comparisons will be shown. Details of the efficient grid perturbation schemes will also be presented, and desirable enhancements for the two codes will be indicated.

Author

Aerodynamic Configurations; Aircraft Design; Supersonic Transports; Optimization; Adjoints; Applications Programs (Computers); Design Analysis

20000057226 NASA Langley Research Center, Hampton, VA USA

Afbody Closure Effects on the Reference H Configuration at Subsonic and Transonic Speeds

Wahls, Richard A., NASA Langley Research Center, USA; Owens, Lewis R., Jr., NASA Langley Research Center, USA; Londenberg, W. Kelly, Vigyan Research Associates, Inc., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 529-560; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Experience with afterbody closure effects and accompanying test techniques issues on a High Speed Civil Transport (HSCT)-class configuration is described. An experimental data base has been developed which includes force, moment, and surface pressure data for the High Speed Research (HSR) Reference H configuration with a closed afterbody at subsonic and transonic speeds, and with a cylindrical afterbody at transonic and supersonic speeds. A supporting computational study has been performed using the USM3D unstructured Euler solver for the purposes of computational fluid dynamics (CFD) method assessment and model support system interference assessment with a focus on lower blade mount effects on longitudinal data at transonic speeds. Test technique issues related to a lower blade sting mount strategy are described based on experience in the National Transonic Facility (NTF). The assessment and application of the USM3D code to the afterbody/sting interference problem is discussed. Finally, status and plans to address critical test technique issues and for continuation of the computational study are presented.

Author

Afterbodies; Computational Fluid Dynamics; Computational Grids; Wind Tunnel Tests; Aerodynamic Configurations

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Model Deformation Measurement Technique NASA Langley HSR Experiences

Burner, A. W., NASA Langley Research Center, USA; Wahls, R. A., NASA Langley Research Center, USA; Owens, L. R., NASA

Langley Research Center, USA; Goad, W. K., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 561-578; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Model deformation measurement techniques have been investigated and developed at NASA's Langley Research Center. The current technique is based upon a single video camera photogrammetric determination of two dimensional coordinates of wing targets with a fixed (and known) third dimensional coordinate, namely the spanwise location. Variations of this technique have been used to measure wing twist and bending at a few selected spanwise locations near the wing tip on HSR models at the National Transonic Facility, the Transonic Dynamics Tunnel, and the Unitary Plan Wind Tunnel. Automated measurements have been made at both the Transonic Dynamics Tunnel and at Unitary Plan Wind Tunnel during the past year. Automated measurements were made for the first time at the NTF during the recently completed HSR Reference H Test 78 in early 1996. A major problem in automation for the NTF has been the need for high contrast targets which do not exceed the stringent surface finish requirements. The advantages and limitations (including targeting) of the technique as well as the rationale for selection of this particular technique are discussed. Wing twist examples from the HSR Reference H model are presented to illustrate the run-to-run and test-to-test repeatability of the technique in air mode at the NTF. Examples of wing twist in cryogenic nitrogen mode at the NTF are also presented.

Author

Aircraft Models; Wind Tunnel Tests; Deformation; Bending Moments; Twisted Wings; Photogrammetry

20000057228 NASA Langley Research Center, Hampton, VA USA

Boundary Layer Transition in the NTF: HSR Experience and Plans

Owens, Lewis R., Jr., NASA Langley Research Center, USA; Wahls, Richard A., NASA Langley Research Center, USA; Hamner, Marvine P., McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 579-596; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Efforts towards understanding boundary layer transition characteristics on a High Speed Civil Transport (HSCT)-class configuration in the National Transonic Facility (NTF) are ongoing. The majority of the High Speed Research (HSR) data base in the NTF has free transition on the wing, even at low Reynolds numbers (Rn) attainable in conventional facilities. Limited data has been obtained and is described herein showing the effects of a conventional, Braslow method based wing boundary-layer trip on drag. Comparisons are made using force data polars and surface flow visualization at selected angles-of-attack and Mach number. Minimum drag data obtained in this study suggest that boundary layer transition occurred very near the wing leading edge by a chord Rn of 30 million. Sublimating chemicals were used in the air mode of operation only at low Rn and low angles-of-attack with no flap deflections; sublimation results suggest that the forebody and outboard wing panel are the only regions with significant laminar flow. The process and issues related to the sublimating chemical technique as applied in the NTF are discussed. Beyond the existing experience, status of efforts to develop a production transition detection system applicable to both air and cryogenic nitrogen environments is presented.

Author

Boundary Layer Transition; Transonic Speed; Wind Tunnel Tests; Drag Measurement; Flow Visualization

20000057231 Boeing Commercial Airplane Co., HSCT Aerodynamics, Seattle, WA USA

HSCT Multi-Point Aerodynamic Performance Trades From TCA Propulsion and Planform Studies

Nelson, Chester P., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 665-679; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Aerodynamics discipline is progressing toward achieving HSCT technology requirements using a "staged" approach. In the initial stage, both High Lift and "Config. Aero" (CA) were primarily focused on validating CFD analysis tools against wind tunnel data from HSCT configurations that were previously designed and optimized using linearized potential flow methods. During the second stage, CA has been intensively involved in developing CFD-based direct nonlinear optimization methods. Thus far, these new tools have been applied only at the supersonic cruise L/Dmax point of the "Ref.H" and "M2.4-7A" configurations. Future steps will include the development of multi-point non-linear aerodynamic optimization capability and the increased use of CFD-based data in Technology Integration "MDO" processes. In anticipation of these developments, this paper reviews the results of the propulsion and airframe integration trades leading up to the selection of the Technology Concept Airplane (TCA), from the perspective of potential multi-point optimization benefits and challenges. The data from these studies provides some

insight into the trade-offs between HSCT supersonic point design L/D, and performance in the transonic and high lift regimes, along with related structural weight considerations.
Author
Supersonic Transports; Aircraft Design; Aerodynamic Characteristics; Optimization; Aerodynamic Configurations

20000057232 McDonnell-Douglas Aerospace, Long Beach, CA USA
CFD Planform Study of the 1400 Series
Kuruvila, G., McDonnell-Douglas Aerospace, USA; Hager, J. O., McDonnell-Douglas Aerospace, USA; Unger, E. R., McDonnell-Douglas Aerospace, USA; Arslan, A. E., McDonnell-Douglas Aerospace, USA; Bruns, D. B., McDonnell-Douglas Aerospace, USA; Sundaram, P., McDonnell-Douglas Aerospace, USA; Martin, G., McDonnell-Douglas Aerospace, USA; Agrawal, S., McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 681-703; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Technology Integration (TI) element of the High Speed Research (HSR) program was tasked with configuring a new Technology Concept baseline aircraft, by the end of 1995, in order to provide, the industry and NASA, a common baseline to serve as the starting point for the next three years of technology development for an HSCT aircraft. The TI team, comprised of personnel from Boeing (BCAG), McDonnell Douglas (MDA), and NASA, selected four distinct planforms: (1) FY94-95 technology baseline, Reference H; (2) MDC HSCT Arrow wing configuration, M2.4-7A; (3) Industry Methodology Test (IMT) airplane; and (4) Planform J, a derivative of M2.4-7A. The team sought inputs from the various disciplines such as Aerodynamics, Structures, Propulsion, etc. in order to select the "best" wing planform for the Technology Concept baseline aircraft. The task of assessing the relative supersonic cruise performance was given to the MDC High Speed Aerodynamics team. One of the key aspects of aerodynamics is the prediction of supersonic cruise lift-to-drag ratio, L/D. Until a few years ago, only linear theory methods had been used for such predictions. However, nonlinear computational fluid dynamics (CFD) methods have recently demonstrated great success in accurately predicting the nonlinear flow physics associated with supersonic Mach numbers on HSCT configurations. They, coupled with optimization methods, have also been used very successfully in optimizing wing and fuselage designs in order to improve the supersonic cruise L/D of HSCT configurations. Recent wind-tunnel tests of the optimized Reference H and M2.4-7A models have also validated the CFD-based design optimization methods. Therefore, this study was focused on applying the validated nonlinear computational methods in not only the prediction of UD, but also in further optimization of the wing and fuselage designs for improved supersonic cruise L/D for configurations initially designed using linear theory methods. Thus, the MDA's CFD study was centered around addressing two questions: (a) How are the potential cruise performance improvements from nonlinear design methods dependent on planform?; and (b) How do the nonlinear design improvements correlate with the linear theory-based projections?. The CFD study involved performing Euler analyses, using CFL3D, of the four baseline configurations and to optimize the four configurations, using MDA version of FLO67/OPT3D, in order to maximize the supersonic cruise UD ratios. In order to remove any biasing of solutions for different configurations, a common set of ground rules was used in the analysis and optimization of all four planforms.
Author
Aerodynamic Configurations; Computational Fluid Dynamics; Lift Drag Ratio; Optimization; Supersonic Transports; Wing Planforms; Applications Programs (Computers)

20000057233 Boeing Co., Seattle, WA USA
Investigation of Non-Linear Effects on Reference H Body Area-Ruling and Cambering
Tamigniaux, Thierry, Boeing Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 705-726; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The goal of this task is to develop a tool capable of investigating non-linear effects on point design body area-ruling and cambering of a HSCT wing/body/diverter/nacelle configuration. Upon completion, this tool is scheduled to be merged with its wing equivalent. The full potential TRANAIR code was used throughout this investigation. TRANAIR's arbitrary geometry and in-house design optimization capabilities allow shape optimization satisfying complex aerodynamic and geometric constraints. The baseline configuration (Reference H) was area-ruled with linear methods at a freestream Mach of 2.1. This investigation into the effects of non-linearity was conducted at Mach 2.4. Optimizations were first conducted at zero lift on an uncambered Reference H configuration. Both mid-wing and low-wing configurations showed no improvement of circular cross-section area distribution over the baseline. Nacelles also had an equally negligible impact on area-ruling of the body. Optimizations were conducted on a cambered Reference H configuration at cruise lift. For that purpose, the optimization routine was extended to include both a minimum interior envelope, a piecewise linear floor definition, and a multi-variable cross-section definition. The optimization

showed that cambering of the fore and aft bodies yielded improvements of up to 1 count of drag. Area-ruling and camber optimization of the same configuration yielded up to 3 counts of drag improvement. In conclusion, this investigation showed that if non-linear methods could not improve on a linear design in zero lift (with or without nacelles), constrained optimizations could significantly improve the area-ruling and cambering of a cambered body in lifting conditions.
Author
Nonlinearity; Optimization; Body-Wing Configurations; Wing Nacelle Configurations; Wing Camber; Supersonic Transports; Computational Fluid Dynamics

20000057234 McDonnell-Douglas Aerospace, Long Beach, CA USA
Fuselage Cross-Sectional Area and Camber Optimization Using Nonlinear Aerodynamic Tools
Hager, James O., McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 727-749; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Previous studies have shown that optimization using nonlinear aerodynamic tools can improve the aerodynamic performance of HSCT configurations designed using linear theory. These studies were restricted to wing camber and twist and fuselage camber changes. The current presentation examines the potential for improved aerodynamic performance by optimizing the fuselage cross-sectional area and camber using nonlinear aerodynamic tools. The 1406 Opt1 configuration was used as the baseline geometry. This configuration was one of the geometries involved in the Technology Integration planform study. It has the same planform as the McDonnell Douglas Aerospace Arrow Wing HSCT configuration, M2.4-7A, and it includes a landing gear fairing in the wing geometry. The results indicate that the fuselage waisting can be removed without incurring an L/D penalty at supersonic conditions (both M(sub infinity)=2.4 and M(sub infinity)=1.1). However, there is a small penalty (about three-quarters of a count of drag) at the transonic cruise condition (M(sub infinity)=0.95).
Author
Aerodynamic Configurations; Supersonic Transports; Wing Camber; Lift Drag Ratio; Optimization; Nonlinearity; Computational Fluid Dynamics

20000057235 McDonnell-Douglas Aerospace, Long Beach, CA USA
Wing Design and Suction/Cooling Requirements for an HSCT with Supersonic Laminar Flow Control
Bharadvaj, Bala, McDonnell-Douglas Aerospace, USA; Roman, Dino, McDonnell-Douglas Aerospace, USA; Sundaram, P., McDonnell-Douglas Aerospace, USA; Powell, Art, McDonnell-Douglas Aerospace, USA; Chang, K. C., McDonnell-Douglas Aerospace, USA; Ng, Lian, Boeing Commercial Airplane Co., USA; Vijgen, Paul, Boeing Commercial Airplane Co., USA; Parikh, Pradip, Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 751-780; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Previous studies on integrating Supersonic Laminar Flow Control (SLFC) on the High Speed Civil Transport (HSCT) have demonstrated significant potential benefits. However, these studies assumed that the aerodynamic design changes needed for laminar flow can be achieved with no adverse impact on the inviscid drag. Also, previous studies estimated suction requirements using conical analysis methods (which were the best tools available at that time). The objective of the present study was to develop an aerodynamic design for the wing of a realistic HSCT configuration, and make estimates of the suction needed using 3D boundary layer stability analysis methods. An additional objective was to explore ways to further reduce the suction needed using a Hybrid Laminar Flow Control (HLFC) scheme combined with surface cooling.
Author
Boundary Layer Control; Boundary Layer Stability; Laminar Boundary Layer; Supersonic Transports; Wing Planforms; Wing Profiles; Drag Reduction; Flow Visualization

20000057236 Boeing Commercial Airplane Co., Seattle, WA USA
Projecting and Tracking Advanced Technology Improvements in L/D
Kulfan, R. M., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 781-844; In English; See also 20000057219; No Copyright; Avail: CASI; A04, Hardcopy; A04, Microfiche

We will discuss the importance of being able to make consistent and accurate of projections of the expected aerodynamic performance improvements that might be achieved by aggressive technology development programs. "Tops Down" aerodynamic projection charts are often used to compare the aerodynamic efficiency of subsonic transports. The drag of a subsonic configuration is not highly dependent on the detailed geometric shape or on the streamwise distribution of lift. Hence, the

Lift/Drag ratio can be related to a single parameter on a universal chart. At supersonic speeds the cruise drag is very dependent on the volume, volume distribution as well as both the spanwise and streamwise distribution of lift. Components of drag for a supersonic configuration will be reviewed. It will be shown that a single simple correlation parameter is not sufficient for supersonic aircraft. Fundamental aerodynamic concepts based on linear theory will be reviewed. These concepts are valid for HSCT type configurations and are used to develop a "tops Down" process for defining "acceptable" aerodynamic design space. This process will be applied to the TCA configuration to develop projections of the cruise L/C performance level.
Author
Supersonic Transports; Aircraft Design; Design Analysis; Lift Drag Ratio; Aerodynamic Drag

20000057252 NASA Langley Research Center, Hampton, VA USA
1997 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 1, Configuration Aerodynamics
Baize, Daniel G., Editor, NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; 948p; In English; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop, 25-28 Feb. 1997, Hampton, VA, USA; Sponsored by NASA Langley Research Center, USA; See also 20000057253 through 20000057270; Original contains color illustrations
Contract(s)/Grant(s): RTOP 537-07-00
Report No.(s): NASA/CP-1999-209691/VOL1/PT2; L-17916C; NAS 1.55:209691/VOL1/PT2; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The High-Speed Research Program and NASA Langley Research Center sponsored the NASA High-Speed Research Program Aerodynamic Performance Workshop on February 25-28, 1997. The workshop was designed to bring together NASA and industry High-Speed Civil Transport (HSCT) Aerodynamic Performance technology development participants in area of Configuration Aerodynamics (transonic and supersonic cruise drag prediction and minimization), High-Lift, Flight Controls, Supersonic Laminar Flow Control, and Sonic Boom Prediction. The workshop objectives were to (1) report the progress and status of HSCT aerodyamic performance technology development; (2) disseminate this technology within the appropriate technical communities; and (3) promote synergy among the scientist and engineers working HSCT aerodynamics. In particular, single- and multi-point optimized HSCT configurations, HSCT high-lift system performance predictions, and HSCT Motion Simulator results were presented along with executive summaries for all the Aerodynamic Performance technology areas.
Author
Supersonic Transports; Aircraft Design; Computational Fluid Dynamics; Aerodynamic Configurations; Optimization

20000057257 Northrop Grumman Corp., Military Aircraft Systems Div., Pico Rivera, CA USA
1996 Nacelle/Diverter Design and Airframe Integration Study
Westra, Bryan W., Northrop Grumman Corp., USA; Malone, Michael B., Northrop Grumman Corp., USA; Peavey, Charles C., Northrop Grumman Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1072-1091; In English; See also 20000057252; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The 1996 Nacelle/Diverter Design and Airframe Integration Study was initiated to develop an understanding of how the nacelle and diverter integration affect the performance of the High Speed Civil Transport Technology Concept Airplane (TCA). Boeing subcontracted Northrop Grumman Corporation (NGC) to assist in the Assessment of Nacelle Integration and the Nacelle/Diverter Integration. NGC's contribution consisted of two tasks: a Nacelle Orientation Study and a Diverter Shape Study. The computations for this study were performed on the NAS Cray C-90 at the cost of approximately 300 CPU hours. Both tasks involved a parametric, viscous CFD analysis and were performed on the full scale TCA at Mach 2.4, altitude 56,500 feet. The objective of the Nacelle Orientation task was to provide guidance for determining the minimum aircraft drag and minimum inlet distortion configurations. For this task, the orientation of the nacelle was changed by varying the toe-in angle, pitch angle, and diverter height. For the Diverter Shape Study, the objective was to provide design criteria for the diverter shape and wing trailing edge to nacelle spacing to minimize the installed, 2D nozzle/nacelle drag. The initial phase of the Diverter Shape Study was to reconcile a viscous drag discrepancy observed in the 1995 Ref. H Transonic Nozzle Boattail Drag Study. It was suspected that the discrepancy was due to flow solver difference between OVERFLOW and GCNSfv. It was determined that the solvers agree within 0.3% (0.4 drag counts) and that the discrepancy was due to different amounts of off-body grid stretching. For the Nacelle Orientation task, eight variants were developed by repositioning the nacelle/diverters. Two variants were created for each geometric variable, i.e. nacelle pitch, inboard nacelle toe angle, outboard nacelle toe angle, and diverter height. Based on the variants, it was predicted that a 0.68 count reduction could be achieved by pitching both nacelles down and toeing-out the inboard nacelle. This optimum configuration was generated and resulted in a 0.66 count reduction. The minimum inlet distortion

configuration was achieved by primarily two adjustments: an inboard nacelle pitch up and an outboard nacelle toe-in. Another eight variants were created for the Diverter Shape task. In addition to the baseline diverter geometry, a thin diverter (similar to the Ref. H diverter) and a NGC developed hybrid diverter shape were examined at different wing trailing edge to nacelle spacings. It was concluded the best diverter shape for drag reduction was the hybrid diverter. The best trailing edge to nacelle spacing was when the aft end of the nacelle was pitched down until it no longer protruded through the upper surface of the wing, giving a 0.65 drag count reduction. Finally, the results of both studies were used to define a configuration that reduced drag by a total of 1.10 counts.
Derived from text
Aerodynamic Configurations; Computational Fluid Dynamics; Engine Airframe Integration; Supersonic Transports

20000057259 Boeing Co., Seattle, WA USA
TCA Stability and Control Assessment Highlighting Computation of Aeroelastic S&C Characteristics Using AEOLAS
Wilson, Douglas L., Boeing Co., USA; Elzey, Mike, Boeing Co., USA; Nishida, Brian, Boeing Co., USA; Titzer, Christine, Boeing Co., USA; Sheckler, Ross, DYNACS Engineering Co., Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1191-1198; In English; See also 20000057252; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

The objectives of the work were to: 1) Assess the high speed stability and control characteristics of the Technology Concept and design variations through computational analysis and experimental wind tunnel testing; 2) Generate a CFD and wind tunnel data base of stability and control characteristics for the baseline and design variations at transonic and supersonic speeds; 3) Make inputs to help guide Technology Configuration development; and 4) Develop design variations to improve stability and control characteristics.
Derived from text
Computational Fluid Dynamics; Wind Tunnel Tests; Aerodynamic Configurations; Aeroelasticity; Applications Programs (Computers)

20000057260 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Improvements to the Single-Block Adjoint-Based Aerodynamic Shape Design Method, SYN87-SB
Reuther, James, Research Inst. for Advanced Computer Science, USA; Saunders, David, Sterling Software, Inc., USA; Hicks, Raymond, MCAT Inst., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1199-1256; In English; See also 20000057252; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This presentation focuses on the enhancements made since July 1996 to the single-block Euler- and adjoint-based wing/body design code, SYN87-SB. For completeness, an introduction to CFD-based design methods in general is given, along with an outline of adjoint-based methods in particular. Comparisons of the adjoint-based gradients with finite differencing are presented, reflecting recent corrections. In conclusion, some future enhancements to the single-block code are listed as desirable-substantial progress with the multiblock SYN87-MB notwithstanding: SYN87-SB's relative ease of use, particularly with its automated grid generation, its proven constraint handling, and its validated ability to approximate the effects of wing-mounted engines for supersonic applications, should ensure its enduring value as an aerodynamic design tool.
Derived from text
Body-Wing Configurations; Computational Fluid Dynamics; Finite Difference Theory; Grid Generation (Mathematics); Adjoints; Gradients; Euler Equations of Motion

20000057261 NASA Ames Research Center, Moffett Field, CA USA
Ames Optimized TCA Configuration
Cliff, Susan E., NASA Ames Research Center, USA; Reuther, James J., Research Inst. for Advanced Computer Science, USA; Hicks, Raymond M., MCAT Inst., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1257-1347; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

Configuration design at Ames was carried out with the SYN87-SB (single block) Euler code using a 193 x 49 x 65 C-H grid. The Euler solver is coupled to the constrained (NPSOL) and the unconstrained (QNMDIF) optimization packages. Since the single block grid is able to model only wing-body configurations, the nacelle/diverter effects were included in the optimization process by SYN87's option to superimpose the nacelle/diverter interference pressures on the wing. These interference pressures were calculated using the AIRPLANE code. AIRPLANE is an Euler solver that uses a unstructured tetrahedral mesh and is capable of computations about arbitrary complete configurations. In addition, the buoyancy effects of the nacelle/diverters were also included in the design process by imposing the pressure field obtained during the design process onto the triangulated surfaces

of the nacelle/diverter mesh generated by AIRPLANE. The interference pressures and nacelle buoyancy effects are added to the final forces after each flow field calculation. Full details of the (recently enhanced) ghost nacelle capability are given in a related talk. The pseudo nacelle corrections were greatly improved during this design cycle. During the Ref H and Cycle 1 design activities, the nacelles were only translated and pitched. In the cycle 2 design effort the nacelles can translate vertically, and pitch to accommodate the changes in the lower surface geometry. The diverter heights (between their leading and trailing edges) were modified during design as the shape of the lower wing changed, with the drag of the diverter changing accordingly. Both adjoint and finite difference gradients were used during optimization. The adjoint-based gradients were found to give good direction in the design space for configurations near the starting point, but as the design approached a minimum, the finite difference gradients were found to be more accurate. Use of finite difference gradients was limited by the CPU time limit available on the Cray machines. A typical optimization run using finite difference gradients can use only 30 to 40 design variables and one optimization iteration within the 8 hour queue limit for the chosen grid size and convergence level. The efficiency afforded by the adjoint method allowed for 50-120 design variables and 5-10 optimization iterations in the 8 hour queue. Geometric perturbations to the wing and fuselage were made using the Hicks/Henne (HH) shape functions. The HH functions were distributed uniformly along the chords of the wing defining sections and lofted linearly. During single-surface design, constraints on thickness and volume at selected wing stations were imposed. Both fuselage camber and cross-sectional area distributions were permitted to change during design. The major disadvantage to the use of these functions is the inherent surface waviness produced by repeated use of such functions. Many smoothing operations were required following optimization runs to produce a configuration with reasonable smoothness. Wagner functions were also used on the wing sections but were never used on the fuselage. The Wagner functions are a family of increasingly oscillatory functions that have also been used extensively in airfoil design. The leading and trailing edge regions of the wing were designed by use of polynomial and monomial functions respectively. Twist was attempted but was abandoned because of little performance improvement available from changing the baseline twist.
Derived from text

Aircraft Design; Aerodynamic Configurations; Euler Equations of Motion; Computational Grids; Finite Difference Theory; Design Analysis; Computational Fluid Dynamics; Optimization; Applications Programs (Computers)

20000057262 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

Development and Validation of a Multi-Block Adjoint Based Design Method

Reuther, James, Research Inst. for Advanced Computer Science, USA; Rimlinger, Mark, Sterling Software, Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1348-1414; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

The development of a multiblock adjoint-based optimization method has been spurred by the desire for efficient treatment of increasingly complex geometries with an enhanced number of design variables and constraints. Prior to the TCA design, efforts at employing aerodynamic shape optimization at NASA Ames have primarily been carried out using a single-block flow solver and a numerical optimization procedure utilizing the finite difference method to obtain gradients of the objective function. However it has become clear that the limitations inherent in this design method prevent its efficient use in the design of complex geometries. These limitations arise from two sources. First, the reliance of the flow solver upon a single-block topology preclude design in the presence of all geometrical features, thus necessitating the development of approximations. In the context of the current HSR design, the inability to model the nacelle-diverter components required the creation of the pseudo-nacelle technique to impose nacelle pressures on the wing surface. Such approximations negatively impact the design effort by requiring a periodic re-analysis of the configuration outside of the design code in order to update surface pressures. Such re-analyses carry with them delays in the design cycle since the meshes for intermediate designs must be regenerated. While it is possible to build a level of automation in the grid generation procedure for geometries of similar planform, such re-analysis efforts may take from 3-5 days. Additionally, and perhaps much more detrimental, benefits obtained through optimization in the presence of approximations fail to capture fully the complexity of component interactions. Hence gains obtained in the design code fail to become realized when analyzed on the full configuration. Moreover, design improvements that arise from complex nacelle-diverter-wing interactions may be impossible to find with the current optimization technique. A second limitation of the traditional design method concerns the use of finite difference methods to obtain gradient information. In a previous presentation, an adjoint method for the Ames single-block design tool (SYN87-SB) has been demonstrated to cut the cost of gradient calculations. The steady march toward increasing the complexity of the design geometry is allied with an increase in the required number of grid cells and a desire to augment the number of design variables. Thus traditional finite difference techniques, which require an additional flow solution for each design variable, begin to require a prohibitive amount of computational resources. In order to surmount these barriers, a multiblock adjoint-based optimization procedure has been developed. In utilizing a flow solver capable of handling a multiblock topology, a degree of flexibility is introduced which permits increasingly complex geometries to be modeled directly in the design code, hence removing the need for approximations. Additionally, the use of an adjoint formulation whereby the design sensitivities

for an arbitrary number of design variables are obtained with the equivalent of two flow calculations brings the cost of obtaining gradient information to an acceptable level. The computational costs in comparison with finite difference methods are further reduced since the adjoint solutions need not be highly converged to be useful.
Derived from text
Aerodynamic Configurations; Aircraft Design; Design Analysis; Multiblock Grids; Gradients; Adjoints; Optimization; Computational Fluid Dynamics

20000057263 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Future Advances in Aerodynamic Shape Optimization
Reuther, James, Research Inst. for Advanced Computer Science, USA; Rimlinger, Mark, Sterling Software, Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1415-1451; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents an overview of the future direction of aerodynamic shape design as seen by HSR participants at NASA Ames Research Center. Dr. James Reuther recently completed his Ph.D. at the University of California, Davis. He is currently employed at the Research Institute for Advanced Computer Science (RIACS) situated at Ames Research Center and is devoting much of his time to the development of practical aerodynamic design tools using the latest available technologies. Mark Rimlinger is finishing his Ph.D. from Carnegie Mellon University while concurrently being employed by Sterling Software. His primary research activity at Ames is the development of advanced shape design software that will directly interface with CAD systems. The focus of this paper will be to highlight future directions and to show some promising examples of developing technologies. Two other talks at this conference, entitled "Improvements to the Single-Block Adjoint-Based Aerodynamic Shape Design Method, SYN87-SB" and "Development and Validation of a Multi-Block Adjoint-Based Design Method", will be referred to for past and current capabilities as well as the mathematical foundations of aerodynamic shape design. The presentation will review all the available aerodynamic shape design tools used within the HSR program and examine their limitations. Requirements will be explored for: flow solvers, design methods, geometry/mesh generation, and interactive environments.
Author
Aerodynamic Configurations; Aircraft Design; Shapes; Optimization; Applications Programs (Computers); Multiblock Grids; Computational Fluid Dynamics

20000057264 NASA Ames Research Center, Moffett Field, CA USA
An Analysis of CFD and Flat Plate Predictions of Friction Drag for the TCA W/B at Supersonic Cruise
Lawrence, Scott L., NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1452-1477; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents results of a study which attempted to provide some understanding of the relationship between skin friction drag estimates produced by flat plate methods and those produced by Navier-Stokes computations. A brief introduction is followed by analysis, including a flat plate grid study, analysis of the wing flow, an analysis of the fuselage flow. Other results of interest are then presented, including turbulence model sensitivities, and brief analysis of other configurations.
Author
Computational Fluid Dynamics; Flat Plates; Friction Drag; Navier-Stokes Equation; Skin Friction; Aerodynamic Configurations

20000057265 NASA Ames Research Center, Moffett Field, CA USA
Preliminary Comparison of Skin Friction Measurements with CFD Predictions
Kennelly, Robert A., Jr., NASA Ames Research Center, USA; Lawrence, Scott L., NASA Ames Research Center, USA; Flamm, Jeffrey D., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1478-1499; In English; See also 20000057252; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The work to be described was performed at the NASA Langley UPWT (4-ft supersonic), test section #2, during 21-24 May 1996. The configuration being tested was the 1.675% Ref H controls model; test conditions were Ma = 2.40, Re = 3 million/ft. This was an exploration of a new technique, and it was not intended to provide definitive comparison of measured and computed skin friction results. It is, however, hoped that the experience gained will make such a rigorous comparison possible in the future.
Author
Friction Measurement; Skin Friction; Wind Tunnel Tests; Friction Drag; Coefficient of Friction

20000057266 NASA Ames Research Center, Moffett Field, CA USA

Comparison of CFD Predictions of the TCA Baseline

Cappuccio, Gelsomina, NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1500-1549; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The computational fluid dynamics (CFD) comparisons being presented are compared to each other and to wind tunnel (WT) data on the baseline TCA. Some of the CFD computations were done prior to the tests and others later. Only force data (CL vs CD) from CFD will be presented as part of this report. The WT data presented comes from the testing of the baseline TCA in the Langley Unitary Plan Wind Tunnel (UPWT), Test Section #2. There are 2 sets of wind tunnel data being presented: one from test 1671 of model 2a (flapped wing) and the other from test 1679 of model 2b (solid wing). Most of the plots show only one run from each of the WT tests per configuration. But many repeat runs were taken during the tests. The WT repeat runs showed an uncertainty in the drag of +/- 0.5 count. There were times when the uncertainty in drag was better, +/- 0.25 count. Test 1671 data was of forces and pressures measured from model 2a. The wing had cutouts for installing various leading and trailing edge flaps at lower Mach numbers. The internal duct of the nacelles are not designed and fabricated as defined in the outer mold lines (OML) iges file. The internal duct was fabricated such that a linear transition occurs from the inlet to exhaust. Whereas, the iges definition has a constant area internal duct that quickly transitions from the inlet to exhaust cross sectional shape. The nacelle internal duct was fabricated, the way described, to save time and money. The variation in the cross sectional area is less than 1% from the iges definition. The nacelles were also installed with and without fairings. Fairings are defined as the build up of the nacelles on the upper wing surface so that the nacelles poke through the upper surface as defined in the OML iges file. Test 1679 data was of forces measured from model 2a and 2b. The wing for model 2b was a solid wing. The nacelles were built the same way as for model 2a, except for the nacelle base pressure installation. The nacelles were only tested with the fairings for model 2a and 2b during test 1679.

Derived from text

Computational Fluid Dynamics; Wind Tunnel Tests; Wind Tunnel Models; Applications Programs (Computers)

20000057267 NASA Ames Research Center, Moffett Field, CA USA

Propulsion Induced Effects Test Program

Cappuccio, Gelsomina, NASA Ames Research Center, USA; Won, Mark, NASA Ames Research Center, USA; Bencze, Dan, NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1550-1604; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

The objective of this milestone is to assess the propulsion/airframe integration characteristics of the Technology Concept Airplane and design variations through computational analysis and experimental subsonic through supersonic wind tunnel testing. The Milestone will generate a comprehensive CFD and wind tunnel data base of the baseline, and design variations. Emphasis will be placed on establishing the propulsion induced effects on the flight performance of the Technology Concept Airplane with all appropriate wind tunnel corrections.

Derived from text

Aircraft Design; Computational Fluid Dynamics; Engine Airframe Integration; Wind Tunnel Tests; Aerodynamic Configurations

20000057268 NASA Ames Research Center, Moffett Field, CA USA

Inlet Spillage Drag Predictions Using the AIRPLANE Code

Thomas, Scott D., Sterling Software, Inc., USA; Won, Mark A., NASA Ames Research Center, USA; Cliff, Susan E., NASA Ames Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1605-1648; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

AIRPLANE (Jameson/Baker) is a steady inviscid unstructured Euler flow solver. It has been validated on many HSR geometries. It is implemented as MESHPLANE, an unstructured mesh generator, and FLOPLANE, an iterative flow solver. The surface description from an Intergraph CAD system goes into MESHPLANE as collections of polygonal curves to generate the 3D mesh. The flow solver uses a multistage time stepping scheme with residual averaging to approach steady state, but R is not time accurate. The flow solver was ported from Cray to IBM SP2 by Wu-Sun Cheng (IBM); it could only be run on 4 CPUs at a time because of memory limitations. Meshes for the four cases had about 655,000 points in the flow field, about 3.9 million tetrahedra, about 77,500 points on the surface. The flow solver took about 23 wall seconds per iteration when using 4 CPUs. It took about eight and a half wall hours to run 1,300 iterations at a time (the queue limit is 10 hours). A revised version of FLOPLANE (Thomas) was used on up to 64 CPUs to finish up some calculations at the end. We had to turn on more

communication when using more processors to eliminate noise that was contaminating the flow field; this added about 50% to the elapsed wall time per iteration when using 64 CPUs. This study involved computing lift and drag for a wing/body/nacelle configuration at Mach 0.9 and 4 degrees pitch. Four cases were considered, corresponding to four nacelle mass flow conditions. Derived from text

Engine Inlets; Aerodynamic Drag; Computational Grids; Engine Airframe Integration; Drag Measurement

20000057269 Boeing Commercial Airplane Co., HSCT Aerodynamics, Seattle, WA USA

Use of CFD Results in the Excrescence Drag Estimation

Yagmaee, Sasan, Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1649-1667; In English; See also 20000057252; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A Navier-Stokes based method has been developed to assess the excrescence drag contribution to the flight polar build-up process. A major step in the method is the estimation of the local boundary layer thickness and edge conditions from the calculated CFD solution. Initial application of the method has been successful in identifying drag critical areas of the surface, where deviations from the aerodynamically designed smooth sealed surface should be avoided. The drag of a generic excrescence item is also presented. The developed method can be used for accurate and timely assessment of weight/drag trade-off's for manufacturing concepts. The detailed boundary layer data extracted from the viscous Navier-Stokes solution can be a valuable tool in understanding fluid dynamics.

Author

Boundary Layer Thickness; Computational Fluid Dynamics; Drag Measurement; Drag Reduction; Aerodynamic Drag

20000057270 Boeing Commercial Airplane Co., HSCT Aerodynamics, Seattle, WA USA

Trip Drag Corrections to Performance Polars Using Excrescence Methods

Mejia, Kevin M., Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 1668-1690; In English; See also 20000057252; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents an alternative method for the calculation of wind tunnel model trip drag increments for application to the build-up of full scale airplane flight polars. Under Technology Integration Task 20, a benchmark data set of Reference H wind tunnel data was created for test-theory comparisons and increments. Several corrections were applied to increase the fidelity of the benchmark data, one of which was a correction for model trip disk drag. A technique for the estimation of model trip drag is derived based on traditional excrescence drag methods. The method relies on both the experimentally determined drag coefficient of a cylinder and CFD estimations of the boundary layer thickness and magnification factor. For the proper application to full scale airplane predictions, a laminar flow correction is also derived and incorporated. Validation of the proposed method is done by comparison to the Braslow variable roughness size method using wind tunnel test data from both the NASA 2.7% Reference H model and preliminary data from a recent 1.7% TCA test. Agreement between experimental and excrescence methods is best at the baseline trip height of both models, but diverge as trip height is increased. Possible sources for the differences include: test data uncertainty, curve extrapolation, data applicability, magnification factor estimate, and/or boundary layer characteristic estimates. Recommendations are made for additional work to validate the excrescence and other trip drag estimation methods at other test conditions and suggestions are made for additional checks and assessments.

Author

Aerodynamic Coefficients; Aerodynamic Drag; Boundary Layer Thickness; Computational Fluid Dynamics; Wind Tunnel Tests

20000057579 NASA Langley Research Center, Hampton, VA USA

Steady and Periodic Pressure Measurements on a Generic Helicopter Fuselage Model in the Presence of a Rotor

Mineck, Raymond E., NASA Langley Research Center, USA; Gorton, Susan A., NASA Langley Research Center, USA; June 2000; 188p; In English

Contract(s)/Grant(s): RTOP 581-10-11-01

Report No.(s): NASA/TM-2000-210286; NAS 1.15:210286; L-17962; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

A wind tunnel test of a generic helicopter fuselage model with an independently mounted rotor has been conducted to obtain steady and periodic pressure data on the helicopter body. The model was tested at four advance ratios and three thrust coefficients. The periodic unsteady pressure coefficients are marked by four peaks associated with the passage of the four rotor blades. Blade passage effects are largest on the nose and tail boom of the model. The magnitude of the pulse increases with rotor thrust

coefficient. Tabular listings of the unsteady pressure data are included to permit independent analysis. A CD-rom containing the steady and unsteady pressure data presented in the report is available from the authors.
Author
Rotors; Helicopters; Pressure Measurement; Periodic Functions; Thrust

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation.

20000044724 Nebraska Univ., Aviation Inst., Omaha, NE USA
Journal of Air Transportation World Wide, Volume 5
Bowen, Brent D., Editor, Nebraska Univ., USA; Journal of Air Transportation World Wide; March 2000; ISSN 1093-8826; 140p; In English; See also 20000044725 through 20000044730
Report No.(s): UNO-AI-JATWW42; Copyright; Avail: Issuing Activity

The Journal's mission is to provide the global community immediate key resource information in all areas of air transportation. The goal of the Journal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a focal point of the journal will be in the area of aviation administration and policy.
Author
Information Systems; Space Transportation; Research

20000044725 International Civil Aviation Organization, Montreal, Quebec Canada
Consequences of Slot Transactions on Airport Congestion and Environmental Protection
Abeyratne, Ruwantissa I.R., International Civil Aviation Organization, Canada; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 13-36; In English; See also 20000044724; Copyright; Avail: Issuing Activity

Recent trends in the liberalization of market access by many commercial airlines have opened the skies to virtually unlimited flights between many countries. However, this liberalization is stultified by the lack of airport capacity to accommodate the many flights that are generated by demand for capacity. Accordingly, the allocation of slots for open skies airlines remain dependent on the expansion and effective management of airport capacity. This article examines the ramifications of slot allocation on traffic peaking at airports and environmental concerns, which may emerge with this activity.
Author
Air Traffic; Airline Operations; Environment Protection; Slots

20000044726 Ohio Univ., Athens, OH USA
The "Rock": The Role of the Press in Bringing about Change in Aircraft Accident Policy
Johnson, Randy, Ohio Univ., USA; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 38-58; In English; See also 20000044724; Copyright; Avail: Issuing Activity

From 1926 to 1938, the Aeronautics Branch, forerunner of the Federal Aviation Administration (FAA), had been charged with aircraft accident investigation. While the Branch had been investigating accidents since its inception, it had, early in its tenure, put into place a policy making its findings secret. Media and political pressure began to mount in late 1928 over its policy of nondisclosure and the debate brought pressure to bear on the young Aeronautics Branch to reverse its policy and make its findings public. The focusing event for the Branch's policy reversal was the death of Knute Rockne, the famous Notre Dame football coach, in a Transcontinental and Western Airways (TWA) airliner on March 31, 193 1. This paper will examine the role of print media in bringing about a significant, and lasting, change in aircraft accident public-disclosure policy.
Author
Aircraft Accident Investigation; Policies; Transcontinental Systems

20000044727 Embry-Riddle Aeronautical Univ., Daytona Beach, FL USA

Service Quality in the US Airline Industry: Variations in Performance Within Airlines and Between Airlines and the Industry

Rhoades, Dawna L., Embry-Riddle Aeronautical Univ., USA; Waguespack, Blaise, Jr., Embry-Riddle Aeronautical Univ., USA; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 60-76; In English; See also 20000044724; Copyright; Avail: Issuing Activity

This study examined the service quality of 25 U.S. airlines (1987-1996) using data from the Department of Transportation's Air Travel Consumer Report. After a total quality and total complaint rate was calculated for these airlines, a 95 percent confidence interval was placed around the yearly and company means calculated to examine those cases that were significantly different from the mean. Results indicate that while the major carriers are converging toward a higher level of quality, there continues to be significant yearly variation. The service quality of regional carriers was much lower than major carriers and showed much greater variation.

Author

Services; Airline Operations; Civil Aviation; Q Factors

20000044728 Nebraska Univ., Kearney, NE USA

An Examination of the US Regional Airline Policies Regarding Child Restraint Systems

Carstenson, Larry, Nebraska Univ., USA; Sluti, Donald, Nebraska Univ., USA; Luedtke, Jacqueline, Utah State Univ., USA; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 78-88; In English; See also 20000044724; Copyright; Avail: Issuing Activity

A prior study examined the policies of U.S. air carriers with regard to the use of infant restraint systems on board commercial aircraft. This study expands on that earlier study by examining the policies of commuter air carriers in the USA regarding the use of infant restraint systems. The management policy of the commuter air carriers has been investigated and officials of the commuter air carriers were surveyed to determine how the carriage of infants onboard their aircraft varied among commuter airlines. The topics investigated included seat space for infants, restraint systems for infants, and amenities for infant passengers. The results of this study have been analyzed to ascertain if any recommendations can be made to the commuter airlines regarding the carriage of infants onboard their aircraft.

Author

Air Transportation; Airline Operations; Policies

20000044729 London Univ., UK

Flying Lessons: Learning from Ryanair's Cost Reduction Culture

Lawton, Thomas C., London Univ., UK; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 89-106; In English; See also 20000044724; Copyright; Avail: Issuing Activity

Through radically improving the value equation for airline customers, Ryanair has served to shake-up established norms and practices in European aviation. Underpinning its price leadership and market success is a vigorous and relentless cost reduction ethos and resultant low break-even load factor. Ryanair has lowered European airline cost structures considerably, shattering existing cost floors. Few competitors are able to follow, either because they do not know how or they are unable due to social settlement obligations or service commitments. At the same time, the company has maintained high average load factors on its flights. Taken in conjunction with its low break-even load factor, this results in consistently high overall profit margins. On this basis, Ryanair is likely to remain a significant competitor and increase its market presence and success across Europe.

Author

Airline Operations; Cost Reduction; Procedures

20000044730 NASA Johnson Space Center, Houston, TX USA

Culture in the Cockpit-CRM in a Multicultural World

Engle, Michael, NASA Johnson Space Center, USA; Journal of Air Transportation World Wide; March 2000; Volume 5, No. 1, pp. 107-118; In English; See also 20000044724; Copyright; Avail: Issuing Activity

Crew Resource Management (CRM) is fundamentally a method for enhancing personal interactions among crewmembers so that safety and efficiency are increased, and at its core involves issues of culture and social interaction. Since CRM is increasingly being adopted by foreign carriers, it is important to evaluate standard CRM techniques from a cultural standpoint, especially if some of these techniques may be enhanced by adapting them to particular cultures. The purpose of this paper is to propose a model for an ideal CRM culture, and to suggest ways that CRM may be adapted to suit particular cultures. The research

method was a simple literature search to gather data on CRM techniques and multicultural crews. The results indicate that CRM can be tailored to specific cultures for maximum effectiveness.
Author
Cockpits; Resources Management; Procedures

20000046628 Cranfield Univ., Cranfield, UK
The Role of Capital Productivity in British Airways' Financial Recovery
Morrell, Peter, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 84-98; In English; Copyright; Avail: Issuing Activity

British Airways (BA) was privatized in 1987, but its financial recovery occurred a number of years earlier, This recovery was sustained throughout the early 1990s economic recession, a period when few major airlines were operating profitably. This paper examines the role of productivity developments at British Airways from the early 1980s through 1996. The emphasis is on capital productivity and investment, but changes in capital intensity and labour productivity are also evaluated. Various measures are considered for both capital and labour productivity: outputs are measured in available tonne-kms (ATKs) and revenue tonne-kms (RTKs), with the former preferred over the latter two measures, after adjustment for work performed by BA for others. Capital inputs are measured in equivalent lease costs adjusted to constant prices with a different treatment of flight and ground equipment or assets. Labour inputs are derived from total payroll costs deflated by a UK wage price index. The airline made considerable capital investments over the period and at the same time went through two major processes of labour restructuring. This resulted in a gradual increase in capital intensity, relative high labour productivity growth, but poor capital productivity performance, However, capital investment played an important role in the airline's sustained labour and total factor productivity over the whole period.
Author
UK; Airline Operations; Civil Aviation; Cost Analysis; Productivity

20000046629 Cranfield Univ., Bedford, UK
The Effect of Corporate Influence in the Short Haul Business Travel Market
Mason, Keith J., Cranfield Univ., UK; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 66-82; In English; Copyright; Avail: Issuing Activity

The importance of corporate involvement in the decision making process for business related air travel is being increasingly recognized in the literature. Business travellers consume air services (i.e. they take airline flights), however; they may not be the principal decision-maker in the purchase, Also it is the organization that employs the traveller that incurs the cost for air travel, Consequently this research addresses the relationship between the traveller and the employing organization in the purchase of air travel. In this paper traveller opinions on their corporate travel policy are evaluated using a Likert summated rating scale. The benefits sought, by the traveller, from the air service are also investigated and these benefits are used to segment the short haul business air travel market in the EU. Changes in the market for short haul business travel since the full liberalisation of the aviation market in the EU are evaluated by comparing the data to an earlier study of similar travellers in 1992.
Author
Policies; Organizations; Airline Operations; Decision Making

20000046631 Jordan Univ. of Science and Technology, Irbid, Jordan
Stochastic Modeling of Airlines' Scheduled Services Revenue
Hamed, M. M., Jordan Univ. of Science and Technology, Jordan; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 32-48; In English; Copyright; Avail: Issuing Activity

Airlines' revenue generated from scheduled services account for the major share in the total revenue. As such, predicting airlines' total scheduled services revenue is of great importance both to the governments (in case of national airlines) and private airlines. This importance stems from the need to formulate future airline strategic management policies, determine government subsidy levels, and formulate governmental air transportation policies. The prediction of the airlines' total scheduled services revenue is dealt with in this paper. Four key components of airline's scheduled services are considered. These include revenues generated from passenger, cargo, mail, and excess baggage. by addressing the revenue generated from each schedule service separately, air transportation planners and designers arc able to enhance their ability to formulate specific strategies for each component. Estimation results clearly indicate that the four stochastic processes (scheduled services components) are represented

by different Box-Jenkins ARIMA models. The results demonstrate the appropriateness of the developed models and their ability to provide air transportation planners with future information vital to the planning and design processes.
Author
Stochastic Processes; Mathematical Models; Airline Operations; Schedules; Revenue; Services; Air Transportation

20000046632 University of Southern Georgia, Statesboro, GA USA
Outsourcing as an Airline Strategy
Brown, John H., University of Southern Georgia, USA; Rutner, Stephen M., University of Southern Georgia, USA; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 22-30; In English; Copyright; Avail: Issuing Activity

Since the deregulation of the airline industry, carriers have searched for any method to improve their competitive position. At the same time, there has been a growth in the use of Third Party Logistics throughout corporate America, This paper presents an overview of the Third Party Logistics system of outsourcing and insourcing within the airline industry. This discussion generated a number of propositions, possible future scenarios and opportunities for empirical testing.
Author
Logistics; Airline Operations

20000046633 Belgrade Univ., Yugoslavia
Determining Usability Versus Cost and Yields of a Regional Transport
Gvozdenovic, Slobodan, Belgrade Univ., Yugoslavia; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 120; In English; Copyright; Avail: Issuing Activity

Regional transports are designed to operate on air networks having the basic characteristics of short trip distances and low density passengers/cargo, i.e. small numbers of passengers per flight. Regional transports passenger capacity is from 10 to 100 seats and operate on routes from 350 to 1000 nautical miles (nm). An air network operated by regional transports has the following characteristics: (1) connecting regional centers; (2) operating on low density passengers/cargo flow services with minimum two frequencies per day; (3) operating on high density passengers/cargo flow with more than two frequencies per day; and (4) operating supplemental services whenever market demands in order to help bigger capacity aircraft already operating the same routes. In order to meet passenger requirements providing low fares and high or required number of frequencies, airlines must constantly monitor operational costs and keep them low. It is obvious that costs of operating aircraft must be lower than yield obtained by transporting passengers and cargo. The requirement to achieve favorable yield/cost ratio must provide the answer to the question of which aircraft will best meet a specific air network. An air network is defined by the number of services, the trip distance of each service, and the number of flights (frequencies) per day and week.
Derived from text
User Requirements; Commercial Aircraft; Operating Costs; Cargo; Airline Operations

20000050363 Federal Aviation Administration, Washington, DC USA
Notices to Airmen, Domestic/International, March 23, 2000
Mar. 23, 2000; 288p
Report No.(s): PB2000-104213; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Contents include the following: Airway Notams; Airports, Facilities, and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices. NTIS
Air Navigation; Runways; Airports; Graphs (Charts)

20000051482 Federal Aviation Administration, Office of Aviation Policy and Plans, Washington, DC USA
FAA Aerospace Forecasts: Fiscal Years 2000-2011
Mar. 2000; 304p; In English
Report No.(s): PB2000-104047; FAA-APO-00-1; No Copyright; Avail: CASI; A03, Microfiche; A14, Hardcopy

This report contains the Fiscal Years 2000-2011 Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities. These include airports with FAA and contract control towers, air route traffic control centers, and flight service stations. Detailed forecasts were developed for the major users of the National Aviation System--air carriers, air taxi/commuters, general

aviation, and military. The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by State and local authorities, the aviation industry, and the general public.
NTIS
Aerospace Industry; Forecasting; Airport Towers; Air Traffic Control; Aircraft Industry; National Aviation System

20000051522 Bureau of Transportation Statistics, Office of Airline Information, Washington, DC USA
Air Carrier Reporting Punctuality Assessment: Accounting and Reporting Directive, No. 243
Mar. 03, 2000; 14p; In English
Report No.(s): PB2000-103416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Office of Airline Information issues its latest 'Air Carrier Reporting Punctuality Assessment' report. The report is issued quarterly covering the most recent six-month period. This report covers the period from July 1, 1999, through December 31, 1999.
NTIS
Air Transportation; Airline Operations

20000051533 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA
Comparing Text and Graphics in Navigation Display Design ***Final Report***
Williams, Kevin W.; Feb. 2000; 16p; In English
Report No.(s): AD-A375445; DOT/FAA/AM-00/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thirty-six pilots were tested in a flight simulator on their ability to decide which of two airports was farther from a storm front, based on the manner in which information was presented on a navigational display. The results support the superiority of graphical over textual information display of nearest airport information. Pilots were significantly faster using the map display than using either the text-only display or the enhanced-text display. In addition, in contrast to an earlier study (Williams, 1999), pilots performed better using a north-up map than when using a track-up map. Discussion of the results focuses on recommendations for moving-map displays and the display requirements for support of the nearest-airport function within a navigational display.
DTIC
Air Navigation; Display Devices; Navigation Aids; Pilot Training; Flight Simulators; Pilot Performance; Storms (Meteorology)

20000052252 Naval Aerospace Medical Research Lab., Pensacola, FL USA
Predicting Primary Flight Grades by Averaging Over Linear Regression Models: Part I
Blower, D. J.; Williams, H. P.; Albert, A. O.; Jan. 01, 2000; 20p; In English
Report No.(s): AD-A375398; NAMRL-1410; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents an investigation into two types of variables that might be useful in predicting flight grades in Navy primary flight training. The first set of predictor variables is largely psychomotor in origin and is part of the Computer-Based Performance Test Battery at the Naval Aerospace Medical Research Laboratory. The second set of variables is more cognitive in nature and arises from scores on the Aviation Selection Test Battery (ASTB) and a final grade in Aviation Pre-Flight Indoctrination (API), which is ground school prior to entering primary flight training. The motivation for this research is a joint effort with the Air Force designed to improve selection tests for military aviators. The emphasis in this report is on how to choose good linear regression models which use these variables to predict a criterion variable such as flight grade. In our present case, we have a total of 25 potential predictor variables. As a result, there is a rather large number of possible regression models. Our task is to pick some relatively small number of models that are best by some acceptable statistical criterion. The analysis revealed that models with a small number of predictor variables were much superior to models that included a large number of the 25 available variables. The best models consisted of two, three, and four predictor variables and possessed an R2 of about .35. The single best model contained the final grade from API, a psychomotor tracking variable, and a score from one of the ASTB subtests. A prediction of the flight grade can then be made by averaging over the individual predictions of the single models. Using Bayesian model evaluation techniques, the averaging is carried out by weighting each individual model according to its posterior probability.
DTIC
Performance Prediction; Evaluation; Aircraft Pilots; Personnel Selection; Psychomotor Performance; Pilot Performance

20000052256 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Situation Awareness in Air Traffic Control: Enhanced Displays for Advanced Operations
Endsley, Mica; Sollenberger, Randy; Nakata, Akiko; Stein, Earl S.; Jan. 2000; 55p; In English
Report No.(s): AD-A375375; DOT/FAA/CT-TN00/01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Future changes in the National Airspace System indicate a self-separation operational concept. This study examined the Air Traffic Control Specialist's ability to maintain situation awareness and provide needed monitoring and separation functions under this concept. The study also provides an empirical evaluation of the effects of an enhanced display concept as a window on the existing air traffic control radar display. This window furnished the targeted altitude or heading of aircraft in a transitionary state. This information simulated that provided by a data link from the aircraft flight management system in a future air traffic operation. The introduction of the enhanced display appeared to have some utility in aiding controllers in dealing with air traffic operating under self-separation. The enhanced display resulted in improvements in some air traffic control performance and situation awareness measures. Results suggest that further improvements in the enhanced display may better integrate it with the controller radar display. In addition, researchers recommend methods for measuring controller situation awareness in future air traffic control research.

DTIC

Air Traffic Control; Air Traffic Controllers (Personnel); Flight Management Systems; Pilot Support Systems; National Airspace System

20000052924 NASA Langley Research Center, Hampton, VA USA

An Analysis of the Role of ATC in the AILS Concept

Waller, Marvin C., NASA Langley Research Center, USA; Doyle, Thomas M., Adsystech, Inc., USA; McGee, Frank G., Lockheed Martin Engineering and Sciences Co., USA; April 2000; 100p; In English

Contract(s)/Grant(s): RTOP 728-60-10-02

Report No.(s): NASA/TM-2000-210091; L-17949; NAS 1.15:210091; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Airborne information for lateral spacing (AILS) is a concept for making approaches to closely spaced parallel runways in instrument meteorological conditions (IMC). Under the concept, each equipped aircraft will assume responsibility for accurately managing its flight path along the approach course and maintaining separation from aircraft on the parallel approach. This document presents the results of an analysis of the AILS concept from an Air Traffic Control (ATC) perspective. The process has been examined in a step by step manner to determine ATC system support necessary to safely conduct closely spaced parallel approaches using the AILS concept. The analysis resulted in recognizing a number of issues related to integrating the process into the airspace system and proposes operating procedures.

Author

Air Traffic Control; Spacing; Air Transportation

20000052927 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Aircraft Accident Report: Controlled Flight into Terrain, Korean Air Flight 801, Boeing 747-300, HL746, Nimitz Hill, Guam on August 6, 1997

Jan. 13, 2000; 228p

Report No.(s): PB2000-910401; NTSB/AAR-00/01; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report explains the accident involving Korean Air flight 801, a Boeing 747-300, which crashed into high terrain at Nimitz Hill, Guam, on August 6, 1997. Safety issues in the report focus on flight crew performance, approach procedures, and pilot training; air traffic control, including controller performance and the inhibition of the minimum safe altitude warning system at Guam; emergency response; the adequacy of Korean Civil Aviation Bureau and Federal Aviation Administration oversight; and flight data recorder documentation.

NTIS

Aircraft Accidents; Boeing 747 Aircraft; Civil Aviation; Emergencies; Flight Control; Flight Recorders; Human Performance; Safety Management

20000054676 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

Preliminary Model to Simulate the Impact of a Frangible Approach Light Structure by an Aircraft Wing Section

Frijns, R. H. W. M.; Wittlin, G.; deBoer, A.; May 15, 1998; 24p; In English; International Crashworthiness Conference IJCRASH '98, Dearborn, MI., September 9-11, 1998. Sponsored by Rijksluchtvaartdienst, The Hague (Netherlands)

Report No.(s): PB2000-104887; NLR-TP-98227; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Certain types of equipment, such as approach light masts and antennas, need to be positioned close to runways at airports because of operational requirements. The supporting structures of such equipment must be of a 'frangible' nature, in order to reduce the risks to aircraft in case of emergencies. In the feasibility study presented, the suitability of the hybrid DRI/KRASH code to address this problem was investigated, by simulating the impact of a wing section on a fragible approach light structure.

DRI/KRASH simulations were compared with experimental results. The impacts were shown to be simulated well with DRI/KRASH. The overall force of the impactor as well as the overall strain energy computed during the simulations is in good correspondence with the experimentally determined values.
NTIS
Airport Lights; Impact Tests; Aircraft Landing; Runway Lights; Computerized Simulation; Models; Wings; Impact Damage; Impact Prediction

20000054863 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Safety Recommendations Adopted and Issued during the Month of February 2000
Feb. 2000; 180p; In English
Report No.(s): PB2000-916602; NTSB/REC-00/02; No Copyright; Avail: National Technical Information Service (NTIS)
This publication contains safety recommendations in aviation and marine modes of transportation adopted by the National Transportation Safety Board during the month of February 2000.
NTIS
Air Transportation; Accident Prevention; Safety Management

20000055613 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
Evaluation of a Prototype Advanced Taxiway Guidance System (ATGS)
Katz, E. S.; Feb. 2000; 26p; In English; Original contains color illustrations
Report No.(s): PB2000-103678; DOT/FAA/AR-TN00/9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Federal Aviation Administration (FAA) Office of Aviation Research, Airport Technology Research and Development Branch, AAR-410 has designed, installed, and evaluated a prototype Advanced Taxiway Guidance System (ATGS) at the Atlantic City International Airport (ACY). The principal feature of this prototype is automatically controllable taxiway lighting, which is used to provide improved surface route guidance to taxiing aircraft. The system automatically illuminates a specific taxiway route for each arrival and departure thus reducing the chances of an aircraft making a wrong turn. The system is also designed to detect and provide Air Traffic Control (ATC) alarms for potential runway incursions, pilot route deviations, and route conflicts between aircraft.
NTIS
Prototypes; Guidance (Motion); Warning Systems; Runways; Automatic Control

20000055624 Physics and Electronics Lab. TNO, The Hague, Netherlands
Support of RNLAF Transport Operations, Part 3, User's Authorites of the Automated Registration System Air Transport *Ondersteuning Vervoer en Verkeer KLu, Deel 3, Bevoegdheden Gebruikers Geautomatiseerd Registratiesysteem Luchttrasport*
Boots–Theunissen, E. A. M., Physics and Electronics Lab. TNO, Netherlands; Smit, F. G., Physics and Electronics Lab. TNO, Netherlands; July 1996; 50p; In Dutch
Contract(s)/Grant(s): TNO Proj. 25601
Report No.(s): TD96-0054; FEL-96-A056; Copyright; Avail: Issuing Activity
At the moment the RNLAF is changing its Air Transport organization. TNO-FEL supports the RNLAF in this process, in particular by analyzing information flows. In a previous report a description and analysis have been made of the information flow at 334 Air Transport squadron, based at Eindhoven Airport. to facilitate the administrative processes in flight preparation and flight following an information system will be developed. This report contains a description of the users' authorities of this information system.
Author
Air Transportation; Information Flow; Information Systems; Systems Engineering

20000056699 Heilenday (Frank), Olympia, WA USA
Principles of Air Defense and Air Vehicle Penetration *Final Report*
Heilenday, Frank; Mar. 2000; 364p; In English
Report No.(s): AD-A375233; ISBN 0-941-893-02-2; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche
This text presents straightforward methods to analyze air defense and air vehicle penetration. Unique expected value models are developed with frequent numerical examples. Radar (masking, multipath, clutter and low RCS) and electro-optics processing are analyzed, as are electronic warfare, lethal self defense, and AWACS, SAM and Al one-on-one Pk. An integrated air defense system is used to explore relationships among the many factors and inputs. Results from these simple models compare well with

far more sophisticated models. Expected target damage, compounding damage and outcome variability (with dependence in factors and inputs) are also addressed. This text was published in 1988. Included in this copy are: one correction (on Page 5-5) and, six replacement pages (17-10 through 17-15).
DTIC
Air Defense; Electronic Warfare; Penetration; Airborne Radar; Mathematical Models

20000056893 Transportoekonomisk Inst., Oslo, Norway
Forecasting Models for Air Traffic ***Prognosemodeller for Flytrafikken***
Knutheim, G. T.; Jul. 1999; 222p; In Norwegian
Report No.(s): PB2000-103149; TOI-1136/1999; Copyright; Avail: National Technical Information Service (NTIS)

This working report presents different air traffic forecasting models for Norway. The models forecast the number of travellers at 17 chosen links on the conventional Norwegian network. The passengers are divided into two marked segments, business and leisure travellers. Properties and results from models developed in this working report are compared to existing models developed by the Institute of Transport Economics. The existing models are PHOENIX and 'The National Model System for Private Travel.' The working report also presents a reestimation of PHOENIX, including a dividing of this model into business and leisure travellers. The working report also includes a discussion of the underlying data material and the research on which the models are based.
NTIS
Forecasting; Models

20000057161 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Air Traffic Control Specialist Visual Scanning, 2, Task Load, Visual Noise, and Intrusions Into Controlled Airspace
Willems, Ben; Allen, Robert C.; Stein, Earl S.; Dec. 1999; 137p; In English
Report No.(s): AD-A372988; DOT/FAA/CT-TN99/23; DOT/FAA/AAR-100; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Federal Aviation Administration (FAA) started an Air Traffic Control Specialist (ATCS) information-scanning program a number of years ago. The goal is to learn about how controllers use information displays and develop techniques for reducing air traffic-related errors. This report describes a research project conducted at the Research Development and Human Factors Laboratory of the FAA William J. Hughes Technical Center. Volunteer controllers participated in a real-time, air traffic control simulation of airspace modeled after their Terminal Radar Approach Control (TRACON) facility. ATCSs worked two different levels of simulated traffic. Some scenarios contained incursions into their Class C airspace, and overflights provided visual noise. Results indicated that the ATCSs' workload increased with higher traffic loads. However, visual noise had more impact on their perceived workload when things were slower and not when they were already busy. An eye tracker recorded eye movements. The visual scanning data included fixations, saccades, blinks, and pupil information. Increased traffic loads decreased the number of fixations on the radarscope. The increase in task load seemed to divert the ATCSs' attention to areas other than the scope, most specifically the keyboard, suggesting they were spending more time updating flight plans and less time scanning the scope. Controllers developed scanning patterns that focused on the areas of highest traffic density. This may be why they identified airspace intrusions late or not at all in some specific cases. Such lapses suggest that intrusion targets must be emphasized with color, blinking, or some other means to draw the controllers attention from established patterns. This may increase airspace safety.
DTIC
Air Traffic Control; Human Factors Engineering; Scanning; Air Traffic Controllers (Personnel)

20000057197 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 28, Number 4
Apr. 2000; 12p; In English
Report No.(s): AD-A376686; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article is drawn from information from the Safety Center database, and from a study conducted for the Flight Safety Foundation of approach and landing accidents worldwide. Summary statistics, conclusions of the study, and approach tips and techniques are presented to highlight the risk involved and possible ways of assessing and dealing with that risk. USASC DATA A review of US Army Safety Center accident data of IFR accidents since FY80 provided the basis for the following results. The review encompassed all Class A accidents involving Army aircraft on instrument-flight plans. The data did not include any data associated with inadvertent IMC mishaps. Since FY80 there have been 18 Class A IFR accidents. of these accidents, 33% were

rotary wing and 67% were fixed-wing. There were 25 fatalities with approximately the same ratio of rotary-wing/fixed-wing fatalities - 32% and 68% respectively.
DTIC
Information Management; Risk; Aircraft Accidents; Flight Safety; Armed Forces (USA)

20000057344 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of March 2000
Mar. 2000; 166p
Report No.(s): PB2000-916703; NTSB/IDBOO-00/03; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This publication contains all Judges Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases for March 2000.
NTIS
Safety Management; Air Transportation; Accident Prevention

20000057345 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Safety Recommendations Adopted and Issued during the Month of April 2000
Apr. 2000; 26p
Report No.(s): PB2000-916604; NTSB/REC-00/04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This publication contains safety recommendations in aviation mode only of transportation adopted by the National Transportation Safety Board during the month of April 1, 2000.
NTIS
Safety Management; Air Transportation; Accident Prevention

20000057414 Federal Aviation Administration, Aviation Security Research and Development Div., Atlantic City, NJ USA
Test and Evaluation Plan for Image Scan Holding's Axix-3D X-ray Machine *Final Report*
Barrientos, J. M.; Snyder, M. D.; Apr. 1999; 30p; In English
Report No.(s): PB2000-105036; DOT/FAA/AR-00/23; No Copyright; Avail: National Technical Information Service (NTIS)
This Test and Evaluation Plan describes the evaluation process for comparing screener performance with Imagine Scan Holding's AXIS-3D X-ray System and conventional X-ray machine technology. All data from this Test and Evaluation will be compiled and analyzed with results to follow in a Test and Evaluation Report.
NTIS
Scanners; X Ray Apparatus; Threat Evaluation

20000057415 Federal Aviation Administration, Aviation Security Research and Development Div., Atlantic City, NJ USA
Test and Evaluation Plan for the Rapiscan Dual View X-ray Machine
Snyder, M. D.; Barrientos, J. M.; Mar. 2000; 24p; In English
Report No.(s): PB2000-105035; DOT/FAA/AR-00/21; No Copyright; Avail: National Technical Information Service (NTIS)
This Test and Evaluation Plan describes the evaluation process of dual-view X-ray technology. While a conventional Rapiscan X-ray machine presents only a top-down view of passenger baggage, their Duel View system presents both a top-down and a side view (on individual monitors). Screener performance with this additional view will be compared to performance with only the conventional top-down view. Measures of detection performance will be recorded, analyzed, and evaluated, in addition to usability issues. to acquire usability data, human factors engineers will assess the Dual View system from a technical perspective and screeners will answer questionnaires so the system can be assessed from a user's perspective. The results will be published in a test and evaluation report.
NTIS
Human Factors Engineering; X Ray Apparatus; Threat Evaluation

20000057455 Naval Postgraduate School, Monterey, CA USA
Analysis and Evaluation of Current Challenges in the Aeromedical Evacuation Mission Segment of the Civil Reserve Air Fleet
Richardson, Dawn D.; Mar. 2000; 63p; In English
Report No.(s): AD-A376459; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Civil Reserve Air Fleet (CRAF) is a contractual arrangement between Air Mobility Command (AMC) and U.S. air carriers. The agreement states that the airlines will commit a specified number of planes to AMC in return for a portion of peacetime government business. The Aeromedical Evacuation (AE) segment of CRAF is the only segment that requires modification to committed aircraft and, therefore, more risk to the airlines. Up until fiscal year 2000, AMC had never filled its requirements for AE. AMC would like to have more airlines join the AE segment, with each airline providing a few aircraft. This thesis considers the history of the program, lessons learned from previous operations, current strategies, and some alternatives to investigate in order to improve the CRAF AE program and participation by the airlines.
DTIC
Air Transportation; Medical Services; Airline Operations; Evacuating (Transportation)

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control.

20000045693 Georgia Inst. of Tech., Dept. of Industrial and Systems Engineering, Atlanta, GA USA
Pilot Performance on New ATM Operations: Maintaining In-Trail Separation and Arrival Sequencing
Pritchett, Amy R., Georgia Inst. of Tech., USA; Yankosky, L. J., Georgia Inst. of Tech., USA; [1999]; 8p; In English
Contract(s)/Grant(s): NAG2-1178; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Cockpit Display of Traffic Information (CDTI) may enable new Air Traffic Management (ATM) operations. However, CDTI is not the only source of traffic information in the cockpit; ATM procedures may provide information, implicitly and explicitly, about other aircraft. An experiment investigated pilot ability to perform two new ATM operations - maintaining in-trail separation from another aircraft and sequencing into an arrival stream. In the experiment, pilots were provided different amounts of information from displays and procedures. The results are described.
Author
Pilot Performance; Air Traffic Control; Experimentation

20000047449 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
Flight Testing of Radio Navigation Systems *les Essais en vol des systemes de radionavigation*
April 2000; 83p; In English; CD ROM contains the entire document presented in PDF format
Report No.(s): RTO-AG-300-Vol-18; AC/323(SCI)TP/26-Vol-18; ISBN 92-837-1039-8; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

Civil as well as military aviation relies on a number of radio navigation systems including satellite systems in space. As new systems are developed extensive flight testing is needed to ensure that the design parameters are met. The approval of every new installation is dependent on flight tests. Moreover, all installations require flight inspection in well-defined time periods. The development and application of cost effective flight test techniques and instrumentation systems including the test aircraft are presented. Room is given also to the adverse effects of radio wave propagation like multipath.
Author
Flight Tests; Radio Navigation; Navigation Aids; Inspection

20000052474 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ionosphere Delay Calibration and Calibration Errors for Satellite Navigation of Aircraft
Harris, Ian, Jet Propulsion Lab., California Inst. of Tech., USA; Manucci, Anthony, Jet Propulsion Lab., California Inst. of Tech., USA; Iijima, Byron, Jet Propulsion Lab., California Inst. of Tech., USA; Lindqwister, Ulf, Jet Propulsion Lab., California Inst. of Tech., USA; Muna, Demitri, Jet Propulsion Lab., California Inst. of Tech., USA; Pi, Xiaoqing, Jet Propulsion Lab., California Inst. of Tech., USA; Wilson, Brian, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Federal Aviation Administration (FAA) is implementing a satellite-based navigation system for aircraft using the Global Positioning System (GPS). Positioning accuracy of a few meters will be achieved by broadcasting corrections to the direct GPS signal. These corrections are derived using the wide-area augmentation system (WAAS), which includes a ground network of at least 24 GPS receivers across the Continental US (CONUS). WAAS will provide real-time total electron content (TEC) measurements that can be mapped to fixed grid points using a real-time mapping algorithm. These TECs will be converted into vertical delay corrections for the GPS L1 frequency and broadcast to users every five minutes via geosynchronous satellite. Users

will convert these delays to slant calibrations along their own lines-of-sight (LOS) to GPS satellites. Uncertainties in the delay calibrations will also be broadcast, allowing users to estimate the uncertainty of their position. to maintain user safety without reverting to excessive safety margins an empirical model of user calibration errors has been developed. WAAS performance depends on factors that include geographic location (errors increase near WAAS borders), and ionospheric conditions, such as the enhanced spatial electron density gradients found during ionospheric storms.
Author
Calibrating; Error Analysis; Global Positioning System; Positioning; Air Navigation; Ionospheric Noise

20000053502 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ground-Based GPS as a Calibration/Validation Tool for Tropospheric Sensing Instruments
Bar–Sever, Y. E., Jet Propulsion Lab., California Inst. of Tech., USA; Haines, B. J., Jet Propulsion Lab., California Inst. of Tech., USA; Keihm, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; 1999; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The tropospheric sensing capabilities of ground-based GPS have been the subject of intensive validation efforts in recent years. But a maturing GPS technology is now rapidly becoming a valuable calibration/validation tool in its own right. We will describe two applications where ground-based GPS receivers have been used as a calibration/validation tool. The first such case is the Cassini gravitational wave media calibration project. A water vapor radiometer (WVR) will calibrate the telemetry signal from the Cassini spacecraft for line-of-sight wet tropospheric fluctuations. The demanding mission specifications require that the WVR's retrieval of wet delay from measurements of brightness temperature be precisely calibrated. We will describe the results from a special campaign to calibrate the WVR's retrieval algorithm with GPS. The second case involves the Topex/Poseidon microwave radiometer (TMR) which is used to calibrate the altimetric measurement for the effect of tropospheric water vapor. Using GPS data from 1992 to 1997 we detected an anomalous drift in columnar water vapor measurements from the TMR. The TMR's spurious drift implies that the uncalibrated estimate of global mean sea level change from Topex/Poseidon is too low by approximately 1 mm/yr. We will discuss the challenges of using long-term time series and problems relating to using the global GPS network as a calibration tool.
Author
Ground Based Control; Global Positioning System; Receivers; Calibrating; Proving; Instrument Errors

20000054868 NASA Glenn Research Center, Cleveland, OH USA
A Hybrid Satellite-Terrestrial Approach to Aeronautical Communication Networks
Kerczewski, Robert J., NASA Glenn Research Center, USA; Chomos, Gerald J., NASA Glenn Research Center, USA; Griner, James H., NASA Glenn Research Center, USA; Mainger, Steven W., NASA Glenn Research Center, USA; Martzaklis, Konstantinos S., NASA Glenn Research Center, USA; Kachmar, Brian A., Analex Corp., USA; April 2000; 14p; In English; 18th; Communications Satellite Systems, 10-14 Apr. 2000, Oakland, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 576-01-21
Report No.(s): NASA/TM-2000-210028; E-12225; NAS 1.15:210028; AIAA Paper 2000-1213; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rapid growth in air travel has been projected to continue for the foreseeable future. to maintain a safe and efficient national and global aviation system, significant advances in communications systems supporting aviation are required. Satellites will increasingly play a critical role in the aeronautical communications network. At the same time, current ground-based communications links, primarily very high frequency (VHF), will continue to be employed due to cost advantages and legacy issues. Hence a hybrid satellite-terrestrial network, or group of networks, will emerge. The increased complexity of future aeronautical communications networks dictates that system-level modeling be employed to obtain an optimal system fulfilling a majority of user needs. The NASA Glenn Research Center is investigating the current and potential future state of aeronautical communications, and is developing a simulation and modeling program to research future communications architectures for national and global aeronautical needs. This paper describes the primary requirements, the current infrastructure, and emerging trends of aeronautical communications, including a growing role for satellite communications. The need for a hybrid communications system architecture approach including both satellite and ground-based communications links is explained. Future aeronautical communication network topologies and key issues in simulation and modeling of future aeronautical communications systems are described.
Author
Telecommunication; Communication Networks; High Frequencies; Aircraft Communication

20000055368 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Simulation of the North Atlantic Air Traffic and Separation Scenarios
Gerhardt–Falk, Christine M.; Elasyed, E. A.; Livingston, Dale; Colamosca, Brian; Feb. 2000; 180p; In English
Report No.(s): AD-A375940; DOT/FAA/CT-TN00/04; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report presents a comprehensive study of the air traffic over the North Atlantic (NAT) Ocean. The main purpose of the study is to assess the fuel savings benefit of proposed changes to the separation standards in the NAT Minimum Navigation Performance Specification (MNPS) airspace. The report describes in detail the purpose of the study, literature survey of relevant work, requirements for the air traffic simulation, various separation standard scenarios, validation of the simulation model, analysis of the results, and conclusions. Using the separation standards from the 1996 NAT system as the baseline, this study presents analysis of four different separation scenarios: Reduced Vertical Separation Minima, Reduced Vertical and Longitudinal Separation Minima, Reduced Vertical and Horizontal Separation Minima and Free Flight. A fast time simulation model is used to investigate the effect of the separation scenarios on several measures of system performance such as fuel consumption and communication loadings. This study was completed in cooperation with the NAT Implementation Management Group Cost Effectiveness (NICE) Task Force. The results presented in this report represent the findings of the NICE-USA Task Group.
DTIC
Simulation; Air Traffic Control; Air Traffic; Airspace; Functional Design Specifications; Navigation

20000055614 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Optimization of Multi-Runway Sequencing and Scheduling
Steijl, H.; Mar. 1999; 130p; In English
Report No.(s): PB2000-103701; M-871; No Copyright; Avail: National Technical Information Service (NTIS)

In the air traffic world aircraft operators have to cope with growing delays. These delays are mainly caused by operating airports against their maximum capacity. It is therefore useful to study methods for improving the efficiency of airport operations. to do this, the sequence and schedules of arriving and departing aircraft are optimized for airports with three runways. Models representing different airport layouts are developed and optimized using Mixed Interger Programming (MIP). to study the potential advantages of using Network Programming techniques for the optimizations, simplified versions of the models are written in network form and optimized using these techniques. For the optimization with the Mixed Integer Programming technique CPLEX software is used. For the optimization with the Network Programming technique the LSNNO FORTRAN subroutine is used.
NTIS
Runways; Optimization; Air Traffic Control; Air Traffic; Scheduling

20000055615 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Development of a Taxi Planning Tool Using Genetic Optimization
vanHam, F.; Feb. 1999; 124p; In English
Report No.(s): PB2000-103702; M-870; No Copyright; Avail: National Technical Information Service (NTIS)

Within the framework of the joint DUT/FAE and NLR project concerned with A-SMGCS, a taxi-planning tool was developed. to do this, an optimization method called Genetic Optimization was used. This method is based on Darwins evolution theory, stating that successive generations of a population are better adapted to the environment in which the population exists. In the Genetic Optimization method, a group of solutions called a population is created, that is reproduced in a way modeled on the natural world, and in this manner new and (hopefully) better solutions are created. A number of algorithms based on this method is available in the public domain, and some initial tests were done using two different programs, GENESIS and GENOCOP. After the initial tests, it was concluded that GENOCOP seemed to be the most promising algorithm for this particular program, mainly based on the fact that it can handle constraints and that it uses floating point representation, which makes it easier to make the necessary adjustments to the program. Using this program, a tool was developed and a limited optimization of the parameters of the program was performed. With the final version of the program, a comparison was made with a similar tool based on LP and MIP methods. Due to the differences in the modeling, no comparison could be made between the performance of the two tools, but some qualitative comparisons were made.
NTIS
Genetic Algorithms; Air Traffic Control; Taxiing; Optimization

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

20000044866 NASA Ames Research Center, Moffett Field, CA USA
A Computational/Experimental Study of Two Optimized Supersonic Transport Designs and the Reference H Baseline
Cliff, Susan E., NASA Ames Research Center, USA; Baker, Timothy J., Princeton Univ., USA; Hicks, Raymond M., NASA Ames Research Center, USA; Reuther, James J., NASA Ames Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 845-967; In English; See also 20000044865; No Copyright; Avail: CASI; A06, Hardcopy; A06, Microfiche

Two supersonic transport configurations designed by use of non-linear aerodynamic optimization methods are compared with a linearly designed baseline configuration. One optimized configuration, designated Ames 7-04, was designed at NASA Ames Research Center using an Euler flow solver, and the other, designated Boeing W27, was designed at Boeing using a full-potential method. The two optimized configurations and the baseline were tested in the NASA Langley Unitary Plan Supersonic Wind Tunnel to evaluate the non-linear design optimization methodologies. In addition, the experimental results are compared with computational predictions for each of the three configurations from the Enter flow solver, AIRPLANE. The computational and experimental results both indicate moderate to substantial performance gains for the optimized configurations over the baseline configuration. The computed performance changes with and without diverters and nacelles were in excellent agreement with experiment for all three models. Comparisons of the computational and experimental cruise drag increments for the optimized configurations relative to the baseline show excellent agreement for the model designed by the Euler method, but poorer comparisons were found for the configuration designed by the full-potential code.
Author
Nonlinearity; Design Analysis; Optimization; Supersonic Transports; Supersonic Wind Tunnels

20000044867 Boeing Commercial Airplane Co., Seattle, WA USA
Update to the "Summary of Langley Unitary Test 1649 and its Implications on Validity of Viscous and Inviscid Analyses"
Yaghmaee, S., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 969-1007; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The present report is meant to update the TLNSMB calculated results reported in the first NASA/Industry Configuration Aerodynamics Workshop held at NASA Langley Research Center. The update arises from the erroneous inclusion of the forces on the aft-body section of the configurations when comparing the results to the experimental data. Although, this update has little impact on the incremental data, it does considerably improve the agreement in the absolute lift and drag levels. In particular, the calculated drag level is now within a count of experimental data when corrected for the trip drag.
Author
Aerodynamic Configurations; Aerodynamics; Aerodynamic Drag; Viscous Flow; Inviscid Flow

20000044868 McDonnell-Douglas Aerospace, Long Beach, CA USA
Supersonic Aerodynamic Design Improvements of an Arrow-Wing HSCT Configuration Using Nonlinear Point Design Methods
Unger, Eric R., McDonnell-Douglas Aerospace, USA; Hager, James O., McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1009-1040; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper is a discussion of the supersonic nonlinear point design optimization efforts at McDonnell Douglas Aerospace under the High-Speed Research (HSR) program. The baseline for these optimization efforts has been the M2.4-7A configuration which represents an arrow-wing technology for the High-Speed Civil Transport (HSCT). Optimization work on this configuration began in early 1994 and continued into 1996. Initial work focused on optimization of the wing camber and twist on a wing/body configuration and reductions of 3.5 drag counts (Euler) were realized. The next phase of the optimization effort included fuselage camber along with the wing and a drag reduction of 5.0 counts was achieved. Including the effects of the nacelles and diverters into the optimization problem became the next focus where a reduction of 6.6 counts (Euler W/B/N/D) was eventually realized.

The final two phases of the effort included a large set of constraints designed to make the final optimized configuration more realistic and they were successful albeit with a loss of performance.
Author
Aerodynamic Configurations; Arrow Wings; Body-Wing Configurations; Nonlinearity; Design Analysis; Optimization

20000044869 McDonnell-Douglas Aerospace, Long Beach, CA USA
Experimental Investigation of a Point Design Optimized Arrow Wing HSCT Configuration
Narducci, Robert P., McDonnell-Douglas Aerospace, USA; Sundaram, P., McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; Cheung, S., McDonnell-Douglas Aerospace, USA; Arslan, A. E., McDonnell-Douglas Aerospace, USA; Martin, G. L., McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1041-1071; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The M2.4-7A Arrow Wing HSCT configuration was optimized for straight and level cruise at a Mach number of 2.4 and a lift coefficient of 0.10. A quasi-Newton optimization scheme maximized the lift-to-drag ratio (by minimizing drag-to-lift) using Euler solutions from FL067 to estimate the lift and drag forces. A 1.675% wind-tunnel model of the Opt5 HSCT configuration was built to validate the design methodology. Experimental data gathered at the NASA Langley Unitary Plan Wind Tunnel (UPWT) section #2 facility verified CFL3D Euler and Navier-Stokes predictions of the Opt5 performance at the design point. In turn, CFL3D confirmed the improvement in the lift-to-drag ratio obtained during the optimization, thus validating the design procedure. A data base at off-design conditions was obtained during three wind-tunnel tests. The entry into NASA Langley UPWT section #2 obtained data at a free stream Mach number, M(sub infinity), of 2.55 as well as the design Mach number, M(sub infinity)=2.4. Data from a Mach number range of 1.8 to 2.4 was taken at UPWT section #1. Transonic and low supersonic Mach numbers, M(sub infinity)=0.6 to 1.2, was gathered at the NASA Langley 16 ft. Transonic Wind Tunnel (TWT). In addition to good agreement between CFD and experimental data, highlights from the wind-tunnel tests include a trip dot study suggesting a linear relationship between trip dot drag and Mach number, an aeroelastic study that measured the outboard wing deflection and twist, and a flap scheduling study that identifies the possibility of only one leading-edge and trailing-edge flap setting for transonic cruise and another for low supersonic acceleration.
Author
Aerodynamic Configurations; Arrow Wings; Transonic Wind Tunnels; Wind Tunnel Models; Wind Tunnel Tests; Computational Fluid Dynamics; Navier-Stokes Equation; Data Flow Analysis

20000045695 NASA Ames Research Center, Moffett Field, CA USA
Secondary Wing System for Use on an Aircraft
Smith, Brian E., Inventor, NASA Ames Research Center, USA; Nov. 30, 1999; 20p; In English
Patent Info.: Filed 13 Mar. 1997; NASA-Case-ARC-14122-1; US-Patent-5,992,796; US-Patent-Appl-SN-828826; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A secondary wing system for use on an aircraft augments the lift, stability, and control of the aircraft at subsonic speeds. The secondary wing system includes a mechanism that allows the canard to be retracted within the contour of the aircraft fuselage from an operational position to a stowed position. The top surface of the canard is exposed to air flow in the stowed position, and is contoured to integrate aerodynamically and smoothly within the contour of the fuselage when the canard is retracted for high speed flight. The bottom portion of the canard is substantially flat for rotation into a storage recess within the fuselage. The single canard rotates about a vertical axis at its spanwise midpoint. The canard can be positioned between a range of sweep angles during flight and a stowed position in which its span is substantially parallel to the aircraft fuselage. The canard can be deployed and retracted during flight. The deployment mechanism includes a circular mounting ring and drive mechanism that connects the canard with the fuselage and permits it to rotate and to change incidence. The deployment mechanism further includes retractable fairings which serve to streamline the wing when it is retracted into the top of the fuselage.
Author
Airspeed; Canard Configurations; Fuselages; Retractable Equipment; Rotation; Wings; Sweep Angle; Lift Augmentation

20000045991 McDonnell-Douglas Corp., Long Beach, CA USA
Supersonic Cruise Point Design Optimization of TCA
Unger, Eric R., McDonnell-Douglas Corp., USA; Narducci, Robert P., McDonnell-Douglas Corp., USA; Hager, James O., McDonnell-Douglas Corp., USA; Kuruvila, Geojoe, McDonnell-Douglas Corp., USA; Hartwich, Peter M., McDonnell-Douglas Corp., USA; Agrawal, Shreekant, McDonnell-Douglas Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 114-188; In English; See also 20000045988; Original contains

color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

Since July of 1996, McDonnell Douglas (along with other teams from NASA Ames and Boeing Commercial Aircraft Group), has been working on a second series of optimizations for the TCA configuration. The approach used at MDC was conservative in terms of acceptable geometric qualities that were allowed to appear in the final Cycle 2 design. The hope was that any final outcome would be more robust and raise the least amount of uncertainties from other technology disciplines. The downside of this approach was the inability to fully maximize the possible L/D gains within the given, time and within these strict geometric guidelines. This paper presents an overview of MDC's final Cycle 2 configuration. First, a brief introduction and highlights of the new design are given along with some geometric details. Second, a look at the configuration's overall performance and pressure field details will be given. Next, some details of the design constraints that were used during optimization will be described. And finally, the paper will close with a summary of the Cycle 2 configuration and a look ahead to the immediate future. Author

Design Analysis; Optimization; Supersonic Speed; Body-Wing Configurations; Civil Aviation

20000045993 McDonnell-Douglas Aerospace, Long Beach, CA USA

TCA Nacelle Installation Assessment and Design Studies

Arslan, Alan, McDonnell-Douglas Aerospace, USA; Sundaram, Pichuraman, McDonnell-Douglas Aerospace, USA; Shieh, Chih–Fang, McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 255-304; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents the computational investigation of the PAI related study in which the primary objective is to assess and then reduce the installation drag of the nacelles for the TCA configuration at the supersonic cruise condition of M (sub infinity)= 2.4, C (sub L) = 0.1 As a first step in reducing the nacelle installation drag, it is necessary to assess the baseline installation. This assessment refers to interference and installation drag assessments, as well as flowfield assessment, at both flight (Re (sub c) = 212 million) and wind-tunnel (Re (sub c) = 6.36 million) conditions. An analysis of the inlet flowfield quality is necessary to assess alignment. After satisfying inlet constraints by aligning the inlets with the local flowfield, the drag is reassessed. An assessment of the boundary layer height at the diverter leading edge suggests a height reduction for the inboard diverter. Finally, diverter and nacelle shape modifications were attempted with limited success.

Author

Installing; Nacelles; Body-Wing Configurations; Civil Aviation; Diverters; Wind Tunnel Tests; Design Analysis

20000045995 McDonnell-Douglas Corp., Long Beach, CA USA

Uncertainties in HSCT Cruise Drag Prediction

Agrawal, Shreekant, McDonnell-Douglas Corp., USA; Novean, Michael G. B., McDonnell-Douglas Corp., USA; Kuruvila, Geojoe, McDonnell-Douglas Corp., USA; Narducci, Robert P., McDonnell-Douglas Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 376-440; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

Within the High Speed Research (HSR) program, NASA and Industry are jointly developing various technologies so that the U.S. Industry has the capability to launch the High Speed Civil Transport (HSCT) aircraft development in early 2000. One of the primary objectives of the HSR program is to be able to predict the cruise aerodynamic performance of the HSCT configurations with a sufficiently high confidence level that will aide industry in the decision to proceed with the development of the, aircraft and guarantee its performance to its airline customers. This paper addresses the current status in the prediction of drag at primarily the supersonic cruise Mach number (M = 2.4), however, drag at the transonic cruise Mach number (M = 0.9) is also presented, wherever appropriate. The thrust of this paper is the uncertainty (or the confidence level) in drag prediction. Use is made of the available experimental, linear and nonlinear computational, and empirical database to the McDonnell Douglas Corporation (MDC). In some cases, there is sufficient database; in some other cases, there is very little database; and yet in some other cases, there is none available. However, an attempt is made to see where we stand today in the cruise drag prediction, although it is difficult to determine uncertainty levels in all the elements contributing to drag. Please note that the uncertainty levels discussed here are the views of the researchers at MDC only, and they may not represent those at other organizations.

Author

Civil Aviation; Supersonic Transports; Supersonic Speed; Aerodynamic Characteristics; Performance Prediction; Aerodynamic Drag

20000045999 NASA Langley Research Center, Hampton, VA USA
Analysis and Multipoint Design of the TCA Concept
Krist, Steven E., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; Buning, Pieter G., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 544-560; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The goal in this effort is to analyze the baseline TCA concept at transonic and supersonic cruise, then apply the natural flow wing design concept to obtain multipoint performance improvements. Analyses are conducted with OVERFLOW, a Navier-Stokes code for overset grids, using PEGSUS to compute the interpolations between the overset grids.
Author
Civil Aviation; Transonic Flow; Supersonic Flow; Body-Wing Configurations; Design Analysis

20000046000 NASA Langley Research Center, Hampton, VA USA
TLNS3D/CDISC Multipoint Design of the TCA Concept
Campbell, Richard L., NASA Langley Research Center, USA; Mann, Michael J., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 561-586; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents the work done to date by the authors on developing an efficient approach to multipoint design and applying it to the design of the HSR TCA (High Speed Research Technology Concept Aircraft) configuration. While the title indicates that this exploratory study has been performed using the TLNS3DMB flow solver and the CDISC (Constrained Direct Iterative Surface Curvature) design method, the CDISC method could have been used with any flow solver, and the multipoint design approach does not require the use of CDISC. The goal of the study was to develop a multipoint design method that could achieve a design in about the same time as 10 analysis runs.
Author
Civil Aviation; Supersonic Transports; Curvature; Design Analysis; Multigrid Methods

20000046005 McDonnell-Douglas Aerospace, Long Beach, CA USA
Comparison of Linearized Potential Flow Design and Analysis Codes
Morgenstern, John, McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 729-776; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The purpose of this task is to compare high speed aerodynamics design methods to find the most accurate and consistent methods for use in HSR Technology Integration studies. In order to compare design methods for Technology Integration, we first separate drag into the components that each method predicts. CD Friction process differences have been quantified and should not affect drag trends between designs; therefore, the differences are considered acceptable. Based on previous work, differences in CD Wave were relatively small and probably due to differences in the geometry analyzed and the number of cuts used--process improvements are still under investigation. CD Induced and ACD Nacelles were known to have the largest differences, so the most effort has been concentrated in those two areas. This paper discusses only the CD Induced results.
Derived from text
Potential Flow; Linearization; Computational Fluid Dynamics; Aircraft Design; Codes

20000046623 Army Safety Center, Fort Rucker, AL USA
Flightfax: Army Aviation Risk-Management Information. Volume 28, Number 3, March 2000
Mar. 2000; 6p; In English
Report No.(s): AD-A375683; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Flightfax is published by the U.S. Army Safety Center, Fort Rucker, AL 36362-5363. Information is for accident-prevention purposes only and is specifically prohibited for use for punitive purposes or matters of liability litigation, or competition.
DTIC
Safety; Reconnaissance Aircraft; Risk; Management Information Systems; Information Management; Accident Prevention

20000046793 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Metallurgical Examination of a Failed Blade Lag Shock Absorber (Part No. 114H6802) From a CH-47D Chinook Cargo Helicopter *Final Report, Sep. 1995 to present*
Pepi, Marc S.; Grendahl, Scott M.; Champagne, Victor K.; Mar. 2000; 89p; In English

Contract(s)/Grant(s): Proj-SM2D50
Report No.(s): AD-A375958; ARL-TR-2191; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A metallurgical examination was performed on a failed blade lag shock absorber from the aft red rotor blade of an Army cargo helicopter. The U.S. Army Research Laboratory (ARL) and the primary contractor (Boeing Helicopters, Philadelphia, PA) performed a visual examination of the failed part, fluorescent penetrant inspection, fractographic evaluation, metallography, hardness testing, conductivity testing, and chemical analysis. It was concluded that the part failed due to fatigue from an area exhibiting intergranular attack. The corrosive attack was most likely caused by the processing fluids used during the rework process. In addition, the parts may not have been properly aged, as evidenced by the higher-than-nominal yield strength values. An improper aging treatment could have facilitated the intergranular attack.
DTIC
CH-47 Helicopter; Metallography; Shock Absorbers; Rotor Blades; Structural Failure

20000047291 Dassault Aviation, Saint-Cloud, France
Technology Trends for Future Business Jet Airframe
Rouquet, A., Dassault Aviation, France; Chaumette, D., Dassault Aviation, France; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 3-1 - 3-4; In English; See also 20000047290; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

Today's aerospace market is extremely tough; the constant quest for reduced production cost in existing airframes may provide an opportunity for introducing new technologies through re-engineering of structural component. This paper highlights the approach used at Dassault Aviation for the Falcon business jet family. Within the technologies patchwork, choices and solutions are reviewed and discussed using examples.
Author
Technology Assessment; Cost Reduction; Aerospace Industry

20000047292 Defence Evaluation Research Agency, Mechanical Sciences Sector, Farnborough, UK
Future Aluminium Technologies and their Application to Aircraft Structures
Borradaile, J. B., Defence Evaluation Research Agency, UK; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 4-1 - 4-4; In English; See also 20000047290; Copyright Waived; Avail: CASI; A01, Hardcopy

Aluminium remains a predominant material for airframes. Carbon fibre composites and titanium alloys have made in roads especially in some military airframes such as Typhoon and Tornado. However with affordability now having equal emphasis to the classical performance requirements in aircraft design, such as speed. range, payload and stealth, aluminium could soon recover some of these applications. Aerospace manufacturers are giving significant attention to developments in the areas of new aluminium materials, low cost manufacturing and unitized structures. The latter is because the cost of producing aircraft is being driven by the cost of assembly which drives production towards fewer, cheaper-to-assemble parts, whilst maintaining close tolerance in manufacture.
Author
Aluminum; Technology Assessment; Aircraft Structures; Airframes; Carbon Fibers; Fiber Composites; Titanium Alloys

20000048750 NASA Langley Research Center, Hampton, VA USA
Evaluation of Alternate Control Surface Concepts
Campbell, Bryan, NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 2, pp. 2385-2407; In English; See also 20000048733; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Although several viable concepts have been investigated during recent years, time constraints do not allow for a detailed discussion of each. Therefore, only a small segment of these concepts will be discussed during this workshop. Emphasis will be placed on canards, forebody chimes and wing fins. The majority of the data presented were obtained using a 0.01542 scale representation of the HSR Reference-H model. This model was similar in planform, and incorporated fullspan leading-edge flaps and segmented trailing-edge flaps. The high-lift configuration of leading-edges at 30 degrees, and trailing-edges at 10 degrees are shown. The wing had no twist or camber. The forebody and fuselage were simple bodies of revolution. A detachable aft fuselage, complete with empennage, was incorporated during the chine study, and removed during the canard tests. The overall length (including aft fuselage) was approximately 58 inches; and the span was 24 inches.
Derived from text
Canard Configurations; Control Surfaces; Forebodies; Fins; Lift

20000051538 La Sapienza Univ., Dipt. Aerospaziale, Rome, Italy

AGING SYSTEMS IN AERONAUTICS AND SPACE DAMAGE TOLERANCE IN HELICOPTERS

Santini, Paolo, La Sapienza Univ., Italy; Small Rocket Motors and Gas Generators for Land, Sea and Air Launched Weapon Systems; April 2000, pp. K1-1 - K1-9; In English; See also 20000051537; Copyright Waived; Avail: CASI; A02, Hardcopy

The aim of this keynote lecture should be that of introducing the main (or, at least, the common) features of the papers that will be presented during the Workshops that will take place in Corfou this week: Aging Aeronautical Systems, Life Extension for Helicopters, Propulsion and Gas Generators for aerospace vehicles. A keynote lecture may be given in several ways. The most obvious form is probably an overview of the subjects that are to be discussed, trying to connect them together, so as to prepare the audience to a more detailed knowledge of them. However, in this way one runs the risk of saying something that will be repeated much better by the specific Authors, (and, often in a much poorer way than the Authors themselves), also because the time is in general very short. Another way is to address and illustrate forthcoming need and future trends in the area of interest: for this kind of presentation it would be necessary to be able to predict the future, because it happens very often that the future is not so smooth as everybody may imagine at the time of the lecture, and so, after a few years, or even a few months, needs and trends are completely different: a good example is the continuous series of war actions in the Balkans and in the Middle East, that may have a strong impact on the policy of the aeronautical production. I have chosen another approach. When AGARD was established, I had the chance to take part in the first meeting in 1952, and I can well remember the great expectations resting on the new structure. I then followed AGARD through-out the decades, attending many meetings of the Structures and Materials Panel, until I became Panel Member in 1975 and, eventually, Panel Chairman during the period 1986-1988.

Derived from text

Aging (Materials); Mechanical Properties; Aerospace Vehicles; Damage; Fatigue (Materials)

20000052130 Knowledge Systems, Inc., Palmdale, CA USA

Automated Structural Optimization System (ASTROS) Damage Tolerance Module, Volume 2, User's Manual *Final Report, 30 Sep. 1996 - 30 Sep. 1998*

Wang, L.; Atluri, S. N.; Feb. 1999; 55p; In English

Contract(s)/Grant(s): F33615-96-C-3215; AF Proj. 3005

Report No.(s): AD-A375881; AFRL-VA-WP-TR-1999-3069-V-2; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report is part of the documentation that describes the complete development of an SBIR Phase II effort titled, "An ASTROS Compatible Computational Strategy for Evaluating the Aeroelastic Response, Buckling, and Integrity of Composite A/C". This report is one of three manuals that comprise the final documentation. The remaining reports consist of a User's Manual, Volume II, and an Interface Design Document, Volume III. The Automated STRuctural Optimization System (ASTROS) is a multidisciplinary computer program for the preliminary design of aircraft and spacecraft structures. It integrates structures, aerodynamics, controls and optimization to make possible interdisciplinary design. This report describes The work performed to enhance the capability of ASTROS to perform preliminary design optimization of metallic and composite material aircraft, based on damage tolerance requirements. It defines the SBIR technical objectives and gives a technical description of the Damage Tolerance models. The Automated global-local analyzer, the Buckling analysis of a composite with/without delamination, the Finite Element Alternating Method, Fatigue crack growth and optimization are also discussed. Finally a short description of interfacing with ASTROS is given.

DTIC

Design Analysis; Aircraft Design; Optimization; Spacecraft Structures; Tolerances (Mechanics)

20000052131 Knowledge Systems, Inc., Palmdale, CA USA

Automated Structural Optimization System (ASTROS) Damage Tolerance Module, Volume 1 *Final Report, 30 Sep. 1996 - 30 Sep.1998*

Wang, L.; Atluri, S. N.; Feb. 1999; 63p; In English

Contract(s)/Grant(s): F33615-96-C-3215; AF Proj. 3005

Report No.(s): AD-A375882; AFRL-VA-WP-TR-1999-3069-V-1; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report is part of the documentation that describes the complete development of an SBIR Phase II effort titled, "An ASTROS Compatible Computational Strategy for Evaluating the Aeroelastic Response, Buckling, and Integrity of Composite A/C". This report is one of three manuals that comprise the final documentation. The remaining reports consist of a User's Manual, Volume II, and an Interface Design Document, Volume III. The Automated STRuctural Optimization System (ASTROS) is a multidisciplinary computer program for the preliminary design of aircraft and spacecraft structures. It integrates structures, aerodynamics, controls and optimization to make possible interdisciplinary design. This report describes The work performed to enhance the capability of ASTROS to perform preliminary design optimization of metallic and composite material aircraft,

based on damage tolerance requirements. It defines the SBIR technical objectives and gives a technical description of the Damage Tolerance models. The Automated global-local analyzer, the Buckling analysis of a composite with/without delamination, the Finite Element Alternating Method, Fatigue crack growth and optimization are also discussed. Finally a short description of interfacing with ASTROS is given.
DTIC
Optimization; Aircraft Design; Design Analysis; Spacecraft Structures

20000052504 NASA Langley Research Center, Hampton, VA USA
BMI Sandwich Wing Box Analysis and Test
Palm, Tod, Northrop Grumman Corp., USA; Mahler, Mary, Northrop Grumman Corp., USA; Shah, Chandu, Northrop Grumman Corp., USA; Rouse, Marshall, NASA Langley Research Center, USA; Bush, Harold, NASA Langley Research Center, USA; Wu, Chauncey, NASA Langley Research Center, USA; Small, William J., NASA Langley Research Center, USA; [2000]; 11p; In English; 4th; Structures, Structural Dynamics and Materials, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-1342; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A composite sandwich single bay wing box test article was developed by Northrop Grumman and tested recently at NASA Langley Research Center. The objectives for the wing box development effort were to provide a demonstration article for manufacturing scale up of structural concepts related to a high speed transport wing, and to validate the structural performance of the design. The box concept consisted of highly loaded composite sandwich wing skins, with moderately loaded composite sandwich spars. The dimensions of the box were chosen to represent a single bay of the main wing box, with a spar spacing of 30 inches, height of 20 inches constant depth, and length of 64 inches. The bismaleimide facesheet laminates and titanium honeycomb core chosen for this task are high temperature materials able to sustain a 300F service temperature. The completed test article is shown in Figure 1. The tests at NASA Langley demonstrated the structures ability to sustain axial tension and compression loads in excess of 20,000 lb/in, and to maintain integrity in the thermal environment. Test procedures, analysis failure predictions, and test results are presented.
Author
Bismaleimide; Failure; Honeycomb Cores; Sandwich Structures; Structural Design; Titanium; Wings

20000052728 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
F/A-18 Replacement Umbilical Qualification Testing
Jahan, Susan; Miller, Greg; Mar. 24, 2000; 30p; In English
Report No.(s): AD-A375747; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses the F/A-18 umbilical qualification testing. Topics discussed are the qualification test program, lightning test requirement, lightning zone and test parameters, pass/fair criteria, captive carriage tests, static pull tests, and ejection tests.
DTIC
F-18 Aircraft; Captive Tests; Performance Tests; Wire

20000052729 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Establishing a Program for Applying Earned Value Metrics to Flight Test
Rice, Chris; Locksley, Robin; Jan. 2000; 8p; In English
Report No.(s): AD-A375749; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Improving efficiency and decreasing costs are becoming more important as the pressure to procure aircraft weapons systems more quickly and at a lower cost increases. The current tool of choice for tracking program efficiency is Earned Value Management (EVM), which provides indices of cost and schedule performance against an agreed upon baseline for task completion. This paper discusses methods that will he used by the H-1 Upgrades Flight Test Team to implement an EVM scheme to track the efficiency of the flight test program. We will define EVM, discuss, compare the merits of existing metrics for flight test, and propose a database management approach. Bounding the problem and expected metrics are discussed. Finally we will present a methodology for uniformly planning for contingencies and unknown-unknowns so as to permit success to the declared within the work package even in the face of technical challenges.
DTIC
Flight Tests; Data Bases; Data Base Management Systems

20000053011 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Toward Validating a Generic Rotorcraft Model Structure for the Emerging Concepts Technology Applications Categories. Abstract only
Carico, Dean; Jan. 2000; 3p; In English
Report No.(s): AD-A375767; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The high projected cost associated with rotorcraft flight testing and training in the New Millennium needs to be minimized using emerging technology applications. In the past, each service has employed the tendency to develop individual models to support training applications for specific aircraft. Reductions in recent DoD procurement budget imply that multi-service partnerships will be very important in the New Millennium. Testing and training cost reductions may be realized using standardization and automation options in the form of generic structure aircraft models. In theory, the generic simulation structure can be readily set-up to represent a variety of air vehicle models to support testing and training requirements. The ability to select the model level of complexity required for specific applications is also desirable. Comparing a comprehensive engineering rotorcraft model to a reduced order real-time model of the same vehicle will allow the user to address selective fidelity issues. For any model, the issues of verification, validation, and accreditation are very important. Basic validation involves comparing the analytical model response to flight test data. This paper examines the fidelity of a generic structure rotorcraft model in the low airspeed flight regime. Specific low speed mission applications are also examined.
DTIC
Standardization; Training Aircraft; Real Time Operation; Rotary Wing Aircraft; Flight Tests; Aircraft Models

20000053018 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Lessons Learned from Utilizing PEMs in a Flight/Safety Critical System
Jones, Brian; Jan. 1997; 11p; In English
Report No.(s): AD-A375786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1997 the Naval Air Systems Command F/A-18 Flight Control Team was tasked with redesigning the Flight Control Computer's processor card. This was mainly due to parts obsolescence. The old processor incorporated mid-SOs technology. The processor card contract was awarded to the current computer manufacturer. Issues raised due to the obsolescence of military rated ceramic microcircuits: Design options limited using only MIL parts or PEMs with full MIL temp rating, Microcircuit Industry market is PEMs, The most common rating for PEMs in the marketplace today is the commercial grade of O deg C to 7O deg C, How to use and quality commercial grade PEMs for a Military Flight Critical System.
DTIC
Flight Control; Aircraft Equipment; F-18 Aircraft; Airborne/Spaceborne Computers; Microelectronics

20000053027 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Fiber Sensors for Aircraft Health Monitoring
Perez, Ignacio; Sep. 22, 1999; 24p; In English
Report No.(s): AD-A375814; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report objectives were to study, develop and transition fiber sensor technologies for aircraft health monitoring, and to develop reliable readout electronics and analysis software.
DTIC
Systems Health Monitoring; Sensors; Fiber Optics; Aircraft Maintenance; Nondestructive Tests

20000053158 DaimlerChrysler Aerospace A.G., Military Aircraft MT24, Munich, Germany
A Unique Design for a Diverging Flexible Vertical Tail
Sensburg, O., DaimlerChrysler Aerospace A.G., Germany; Schneider, G., DaimlerChrysler Aerospace A.G., Germany; Tischler, V., Wright Lab., USA; Venkayya, V., Wright Lab., USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 1-1 - 1-17; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

A method is developed which allows to use the flexible behaviour of aircraft structures to enhance aerodynamic derivatives. A vertical tail analytical model was used to show these effects and by exploiting the aeroelastic deflections it is possible to reduce the area of this surface up to thirty percent. Numerous applications are possible including fighter and transport airplanes. Since composite structures are involved it is absolutely necessary to use a multidisciplinary optimisation program code such as the US-Airforce ASTROS-code.
Author
Aircraft Design; Tail Assemblies; Applications Programs (Computers); Flexible Bodies; Dynamic Structural Analysis; Aeroelasticity

20000053159 Lockheed Martin Tactical Aircraft Systems, F-22 Structural Dynamics, Fort Worth, TX USA
F-22 Structural Coupling Lessons Learned
Wray, William R., Jr., Lockheed Martin Tactical Aircraft Systems, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 2-1 - 2-9; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

A survey of current F-22 aeroservoelastic analysis and testing activity shows that valuable insight has been gained into several structural coupling and ride quality problems. The aeroservoelastic (ASE) analysis results agree well with flight and ground test measurements. Examples from a recent structural coupling test will be used to illustrate some recent F-22 ASE issues.
Author
Aeroservoelasticity; F-22 Aircraft; Dynamic Structural Analysis; Flight Control; Control Systems Design; Loop Transfer Functions

20000053160 Boeing Phantom Works, Long Beach, CA USA
Aeroservoelastic Modeling, Analysis, and Design Techniques for Transport Aircraft
Baker, Myles L., Boeing Phantom Works, USA; Goggin, Patrick J., Boeing Phantom Works, USA; Winther, Bertil A., Boeing Phantom Works, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 3-1 - 3-6; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Piloted and batch simulations of the aeroservoelastic response of flight vehicles are essential tools in the development of advanced flight control systems. In these simulations the number of differential equations must be sufficiently large to yield the required accuracy, yet small enough to enable real-time evaluations of the aircraft flying qualities and rapid batch simulations for control law design. The challenge of these conflicting demands is made especially difficult by the limited accuracy of the analytical modeling techniques used, nonlinearities in the quasi-steady equations of motion and by the complex characteristics of the unsteady aerodynamic forces. In this paper, a brief survey of some of the techniques that have been used at Boeing to develop aeroservoelastic math models for control system design and evaluation are presented, along with a discussion of the strengths and weaknesses of the various techniques. The modeling techniques discussed include frequency response fitting methods, rational function approximation methods, and the P-Transform technique. Integration of the aeroservoelastic structural dynamic model with a nonlinear flight simulation is also discussed.
Author
Aeroservoelasticity; Control Systems Design; Control Theory; Dynamic Models; Mathematical Models

20000053162 Alenia Aeronautica, Aircraft Engineering, Turin, Italy
Ground Structural Coupling Testing and Model Updating in the Aeroservoelastic Qualification of a Combat Aircraft
Vaccaro, V., Alenia Aeronautica, Italy; Caldwell, B., British Aerospace Aircraft Group, UK; Becker, J., Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 5-1 - 5-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper is concerned with the role played by the ground Structural Coupling Test (SCT) and the update of the aeroservoelastic model in the qualification process of a modern combat aircraft. It represents the completion of Reference 1, after several improvements introduced in the Notch Filter (NF) design procedure, numerous ground test campaigns and the confirmation of flight trials. Most of modern combat aircraft are equipped with fly-by-wire and digital flight control systems (FCS). The problem of interaction between the dynamic response of the airframe and the FCS is usually solved through an appropriate set of notch filters, designed to attenuate the level of structure vibrations picked up by the FCS sensors. Fundamental part of the qualification of the notch filter set is the ground testing activity, generally known as ground Structural Coupling Test. The main subjects of this paper are: (1) Test Procedure; (2) Model update; and (3) Describe how ground test data is used to augment model predictions in areas where the model on its own is not considered adequate for notch filter design.
Author
Aeroservoelasticity; Fighter Aircraft; Flight Control; Ground Tests; Aircraft Structures; Structural Vibration; Control Systems Design

20000053163 Olsen Engineering Consulting, Dayton, OH USA
Unified Flight Mechanics and Aeroelasticity for Accelerating, Maneuvering, Flexible Aircraft
Olsen, James J., Olsen Engineering Consulting, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 6-1 - 6-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper reveals new insights in the aeroelasticity and flight mechanics of flexible aircraft by obtaining and solving the equations of motion for a flexible, accelerating, rotating aircraft. We illustrate the approach for three cases of increasing complexity: The first cast is a "sprung" pendulum. It shows when rigid body angular velocities can be important in the flexibility

equations as they approach as the flexible frequencies. The second case is a typical section airfoil on an accelerating, rotating fuselage. It applies Lagrange's equations to a longitudinal problem in inertial coordinates, then transforms the equations to noninertial, body-fixed coordinates for solution. It also shows when rigid body rotations and longitudinal accelerations must be included in the flexibility equations. The third case is the general longitudinal/lateral motion of an accelerating, rotating, flexible vehicle. Rather than setting up the general problem in inertial coordinates and then transforming to body-fixed coordinates, instead we use the idea of "quasi-coordinates". We establish a general form for Lagrange's equations in the noninertial, body-fixed coordinates. The paper gives the general equations and reduces them to a special case of a "flat" airplane. It also gives guidelines as to when the rigid body rotations and accelerations are important factors in the flexibility equations.
Author
Flight Mechanics; Aeroelasticity; Acceleration (Physics); Rigid Structures; Rotating Bodies; Euler-Lagrange Equation; Mathematical Models; Coordinate Transformations

20000053164 Daimler-Benz Aerospace A.G., Military Aircraft, Munich, Germany
An Integrated Design Procedure for Aircraft Structure Including the Influence of Flight Control System on Aircraft Flutter
Luber, W., Daimler-Benz Aerospace A.G., Germany; Becker, J., Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 7-1 - 7-15; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Modern fighter aircraft are using high sophisticated power control and automatic flight control systems, which basically are designed to maneuver the airplane and to provide sufficient damping for the rigid body modes. Since the sensors are attached to the flexible structure, motions of the elastic aircraft will be measured and may influence the control system. In order to avoid instabilities it is necessary to predict the response of the aircraft with the control system and to correlate with flight test data. An analytical approach for the complete system including flight mechanics and unsteady aerodynamic forces is presented. The elastic structure is described by a set of normal modes which have been updated by results of ground resonance survey tests. Flutter calculations in open and closed loop on different flight conditions as well as incidence variations are demonstrated as common flutter plots. For the flutter analysis a set of notch filter is required, which should be determined in an integrated design step.
Author
Control Systems Design; Flight Mechanics; Flight Control; Flutter Analysis; Aeroservoelasticity; Mathematical Models; Dynamic Models

20000053165 Manchester Univ., School of Engineering, UK
Characterisation of nonlinear aeroservoelastic behaviour
Dimitriadis, G., Manchester Univ., UK; Cooper, J. E., Manchester Univ., UK; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 8-1 - 8-11; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

The characterisation of the behaviour of nonlinear aeroelastic systems has become a very important research topic. Nevertheless, most of the work carried out to date concerns the development of unsteady CFD solutions in the transonic region. Important though this work is, there is also a need for research which aims at understanding the behaviour of nonlinear systems, particularly the occurrence of Limit Cycle Oscillations (LCOs). The purpose of this paper is to study the stability of a simple aeroservoelastic system with nonlinearities in the control system. The work considers both structural and control law nonlinearities and assesses the stability of the system response by use of bifurcation diagrams. It is shown that simple feedback systems designed to increase the stability of the linearized system also stabilise the nonlinear system, although their effects can be less pronounced. Additionally, a nonlinear control law designed to limit the control surface pitch response was found to increase the flutter speed considerably by forcing the system to undergo limit cycle oscillations instead of fluttering. Finally, friction was found to affect the damping of the system but not its stability, as long as the amplitude of the frictional force is low enough not to cause stoppages in the motion.
Author
Aeroservoelasticity; Flutter; Nonlinear Systems; Control Systems Design; Systems Stability; Aircraft Control

20000053168 Air Force Research Lab., Wright-Patterson AFB, OH USA
The Impact of Active Aeroelastic Wing Technology on Conceptual Aircraft Design
Flick, Peter M., Air Force Research Lab., USA; Love, Michael H., Lockheed Martin Tactical Aircraft Systems, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 10-1 - 10-4; In English; See also 20000053157; Copyright Waived; Avail: CASI; A01, Hardcopy

Active Aeroelastic Wing (AAW) Technology represents a new design approach for aircraft wing structure. The technology uses static aeroelastic deformations as a net benefit during maneuvering. AAW is currently being matured through a flight research program; however, transition of the technology to future systems will require educating designers in multiple disciplines on this new design approach. In order to realize the full benefits of AAW, aeroelastic effects will need to be accounted for from the beginning of the design process. Conceptual design decisions regarding wing aspect ratio, wing thickness-to-chord ratio. and wing torque box geometry will be influenced if designers choose to utilize AAW. This paper will present current work in developing conceptual aircraft design guidance for AAW and identify improvements to the design process that could facilitate future AAW design applications. This process involves using results from aeroelastic design methods, typically used in preliminary design, with conventional conceptual design methods. This approach will allow aeroelastic effects to be accounted for while making conceptual design decisions.

Author

Aeroelasticity; Aircraft Design; Aircraft Structures; Aeroelastic Research Wings

20000053169 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany

Active Aeroelastic Aircraft and its Impact on Structure and Flight Control Sytsems Design

Schweiger, Johannes, DaimlerChrysler Aerospace A.G., Germany; Krammer, Johann, DaimlerChrysler Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 11-1 - 11-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Active aeroelastic concepts have been proposed for several years now. Their common incentive are improvements of aircraft performance and stability by the intentional use of aeroelastic effects. This means that the basic flexibility characteristics of a new aircraft project must be included in the early conceptual design process, and the structural and flight control system design must be coupled very closely. The knowledge about the magnitude of aeroelastic impacts on aerodynamic forces and aircraft stability is still very limited within the community of people involved in aeronautical engineering - even among the specialists in aeroelasticity. For a successful application of active aeroelastic concepts, their proper identification is therefore the first step. It will be shown for some selected examples, which static aeroelastic effects are usually very important for conventional designs, and how they can be made even more effective in a positive sense for future designs. The accuracy and proper use of aeroelastic prediction methods and analysis models is addressed briefly in the context of interactions with other disciplines, and ideas are developed for the multi-disciplinary design process of active aeroelastic aircraft concepts. Whereas static aeroelastic effects usually only become important with increasing airspeed, a concept will be demonstrated for aeroelastic improvements, which also works at low speeds.

Author

Aircraft Design; Control Systems Design; Flight Control; Aircraft Structures; Aeroelasticity; Active Control

20000053170 Northrop Grumman Corp., Military Aircraft Systems Div., Pico Rivera, CA USA

Aeroservoelastic Characteristics of the B-2 Bomber and Implications for Future Large Aircraft

Britt, R. T., Northrop Grumman Corp., USA; Volk, J. A., Northrop Grumman Corp., USA; Dreim, D. R., Northrop Grumman Corp., USA; Applewhite, K. A., Northrop Grumman Corp., USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 12-1 - 12-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Design and development of the B-2 Bomber presented many challenges in flexible vehicle control, many related to the unique configuration and design requirements, The technical challenges posed by the aeroelastic characteristics of the all-wing aircraft were recognized at the outset of the development program and included the configuration's near-neutral pitch stability and light wing loading which made the aircraft highly responsive to atmospheric turbulence. This dictated the requirement for an active digital flight control system to provide both stability augmentation and gust load alleviation. The gust load alleviation flight control system was designed by a multidisciplinary team using a combination of optimal and classical control design techniques and a common analysis model database. Accurate representation of the vehicle aerodynamics characteristics, actuators, and sensors were key to successfully developing and testing the flight control system and verifying performance requirements. Flight test data analysis included the extraction of the vehicle open loop response which were utilized to adjust the analytical models and make final revisions to control law gains. The multidisciplinary design approach resulted in the successful development of a control augmentation system that provides the B-2 with superb handling characteristics, acceptable low altitude ride quality, and substantial alleviation of gust loads on the airframe. With this back drop, a technology assessment is performed which discusses potential technology improvements for application to future bomber and large transport aircraft.

Author

Active Control; Aeroservoelasticity; Aircraft Design; Control Systems Design; Control Theory; Flight Control; Technology Assessment; B-2 Aircraft

20000053172 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
Design Aspects of the Elastic Trailing Edge for an Adaptive Wing
Monner, H. P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sachau, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Breitbach, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 14-1 - 14-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

According to predictions of market researchers a large growth in numbers of passengers as well as of airfreight volume can be expected for the civil transport aircraft industry. This will lead to an increased competition between the aircraft manufacturers. to stay competitive it will be essential to improve the efficiency of the new aircraft generation. Especially the transonic wings of civil aircraft with their fixed geometry offer a large potential for improvement. Such fixed geometry wings are optimized for only one design point characterized by the parameters altitude, math number and aircraft weight. Since these vary permanently during the mission of the aircraft the wing geometry is only seldom optimal. As aerodynamic investigations have shown one possibility to compensate for this major disadvantage lies in the chordwise and spanwise differential variation of the wing camber for mission duration. This paper describes the design of a flexible flap system for an adaptive wing to be used in civil transport aircraft that allows both a chordwise as well as a spanwise differential camber variation during flight. Since both lower and upper skins are flexed by active ribs, the camber variation is achieved with a smooth contour and without any additional gaps. This approach for varying the wing's camber is designed to be used for replacement and enhancement of a given flap system. In addition the kinematics of the rib structure allows for adaptation of the profile contour to different types of aerodynamic and geometric requirements.
Author
Mission Adaptive Wings; Wing Camber; Trailing Edges; Flexible Wings; Aeroelasticity; Aircraft Control

20000053175 Aerospatiale Matra Airbus, Toulouse, France
Passenger Comfort Improvement by Integrated Control Law Design
Kubica, Francois, Aerospatiale Matra Airbus, France; Madelaine, Beatrice, Aerospatiale Matra Airbus, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 17-1 - 17-4; In English; See also 20000053157; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper presents comfort criteria based on ISO 2631-1 standard, and shows how these criteria can be applied to a large capacity civil aircraft for passenger comfort evaluation. The results obtained show that fly-by-wire allows to improve comfort with respect to the natural aircraft. More over an active control of the fast flexible modes allows not only to improve "low frequency" comfort (vibrating comfort), but also "very low frequency" comfort (motion sickness phenomenon). This study defines tools for comfort analysis and control law design, which could be used for future large civil aircraft, like the A340-500/600 and the A3XX.
Author
Active Control; Civil Aviation; Fly by Wire Control; Passenger Aircraft; Riding Quality; Vibration Damping

20000053179 Construcciones Aeronauticas S.A., Structural Dynamics and Aeroelasticity Dept., Madrid, Spain
Non Linear Effects of Applied Loads and Large Deformations on Aircraft Normal Modes
Oliver, M., Construcciones Aeronauticas S.A., Spain; Climent, H., Construcciones Aeronauticas S.A., Spain; Rosich, F., Construcciones Aeronauticas S.A., Spain; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 21-1 - 21-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Ground Vibration Test (GVT) is the typical way to verify structural dynamic models. The conditions in which the GVT is performed -the aircraft subjected and deformed under gravity loads- are different from the conditions in which the Finite Element Method (FEM) model is usually elaborated (jig shape without loads). They are also different from the in-flight conditions (the aircraft subjected and deformed under inertia and aerodynamic forces). Although in most cases those differences can be negligible, it is not the case of a very large airplane in which the size and flexibility effects are of such nature that updating a FEM model to match GVT results could go in the opposite direction to the actual airplane in-flight. This paper analyses the influence of aircraft deformation (down bending for GVT, jig shape for FEM model, up bending for flight), shape (control surfaces deflections...), and loads (gravity on ground, inertial and aerodynamic forces in flight) on normal modes to have a better insight in GVT and flight test measurements interpretation of a very large airplane. Those effects are significant especially where large concentrated masses (engine-pylon) are present.
Author
Nonlinear Systems; Finite Element Method; Aerodynamic Forces; Aerodynamic Loads; Ground Effect (Aerodynamics); Aircraft Structures; Elastic Deformation; Dynamic Structural Analysis

20000053180 DaimlerChrysler Aerospace Airbus G.m.b.H., Hamburg, Germany

Flight Simulation within the Frame of Multidisciplinary Optimization of Large Flexible Aircraft

Rommel, Armin, DaimlerChrysler Aerospace Airbus G.m.b.H., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 22-1 - 22-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

The disciplines flight mechanics/flight control and structural dynamics have to work closely together when large flexible aircraft, such as A340-600 and A3XX, are designed. The flight-control system has to be designed under the constraint that structural oscillation resonances or unacceptable levels of structural loads have to be avoided. Especially the integration of flight control and structural control requires multidisciplinary cooperation. In the potential conflict between handling qualities and minimal structural loads requirements the flight-control law parameters have to be optimized. This paper describes enhancements of real-time flight simulation in order to integrate the pilot into the control loop especially with respect to the effects of cockpit accelerations. The enhancements cover the coupling of rigid body motion and flexible modes in order to analyze the effects of neighboring frequencies, as well as the inclusion of simplified loads computation within the real-time simulation environment. Moreover, a cost-effective way of simulation-model development is presented. This covers model development and testing/validation on a fixed-base engineering flight simulator followed by a proven model transfer onto a six degrees of freedom motion simulator where intensive pilot-in-the-loop investigations can be carried out.

Author

Dynamic Structural Analysis; Flexible Wings; Flight Control; Flight Simulation; Multidisciplinary Design Optimization; Mathematical Models

20000053517 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

Full-Scale Fuselage Panel Tests

Vercammen, R. W. A., National Aerospace Lab., Netherlands; Ottens, H. H., National Aerospace Lab., Netherlands; Mar. 23, 1998; 22p; In English

Report No.(s): PB2000-103816; NLR-TP-98148-U; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The fuselage panel test facility at NLR offers the possibility to subject fuselage skin sections to residual strength and fatigue tests. The fatigue test loads simulate cabin pressurization in radial and axial direction and axial loads representative of fuselage bending. to verify the test methodology and the specifications of the test set-up, the performance of the test set-up is evaluated using a GLARE panel designed by Fokker Aircraft. The test results indicate the suitability of the biaxial load introduction systems to load a panel comparable to a panel in a pressurized fuselage subjected to bending. In addition, the tests show that compared to conventional fuselages, the designed GLARE Panel combines a substantial weight reduction with an excellent fatigue behavior and sufficient static strength. Test on fuselage panels designed by Shorts, DASA and Alenia are used to demonstrate the technological feasibility of GLARE fuselages also with window cut-outs, to study the growth of multiple site damage in stiffened lap-joints of aluminum curved panels and to determine the effect of multiple site damage on the residual strength of such panels.

NTIS

Fuselages; Curved Panels; Structural Design

20000053531 Advanced Research and Applications Corp., Sunnyvale, CA USA

Integrated Detector Technology for Corrosion Inspection *Final Report, 1 Jun. 1999-28 Feb. 2000*

Smith, Jerel A.; Feb. 28, 2000; 21p; In English

Contract(s)/Grant(s): F49620-99-C-0032

Report No.(s): AD-A375909; ARACOR-P014FR-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project investigated the use of gas micro-strip detectors as a means of improving the throughput of an innovative technique for detecting hidden corrosion in aging aircraft. The evaluations included the development of system, detector and data-readout concepts capable of meeting the resolution and throughput goals for this instrument, and the modeling and computation of x-ray and electron interactions in the detector. The results of this evaluation indicate that these detectors can be adapted to this application and can achieve the spatial resolution and count rates required to support a system throughput up to 25 m/hr for detection of 5% corrosion in lapjoints. This throughput, nearly two orders-of-magnitude faster than the existing demonstration system, is sufficient to support the use of this instrument as a practical adjunct to existing technologies. The next step in development would be the fabrication of this detector and the demonstration that the sensitivity and throughput targets can be achieved in a demonstration system.

DTIC

Corrosion; Inspection; Gas Detectors; Nondestructive Tests

20000054685 NASA Glenn Research Center, Cleveland, OH USA

Improving the Aircraft Design Process Using Web-Based Modeling and Simulation

Reed, John A., Toledo Univ., USA; Follen, Gregory J., NASA Glenn Research Center, USA; Afjeh, Abdollah A., Toledo Univ., USA; May 2000; 40p; In English

Contract(s)/Grant(s): NAG3-2019; RTOP 509-10-31

Report No.(s): NASA/TM-2000-209953; NAS 1.15:209953; E-12209; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Designing and developing new aircraft systems is time-consuming and expensive. Computational simulation is a promising means for reducing design cycle times, but requires a flexible software environment capable of integrating advanced multidisciplinary and multifidelity analysis methods, dynamically managing data across heterogeneous computing platforms, and distributing computationally complex tasks. Web-based simulation, with its emphasis on collaborative composition of simulation models, distributed heterogeneous execution, and dynamic multimedia documentation, has the potential to meet these requirements. This paper outlines the current aircraft design process, highlighting its problems and complexities, and presents our vision of an aircraft design process using Web-based modeling and simulation.

Author

Aircraft Design; Multimedia

20000055605 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Tail Rotor Flapping

Kolwey, Herman; Sep. 1999; 2p; In English

Report No.(s): AD-A375758; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There was a letter in Feedback, September 1999 issue of Rotor & Wing entitled "Go-No-Go" from James D. Thomas, Jr. of Charleston, WV. The following description addresses my involvement with a Tail Rotor Flapping problem with the SH-3 Helicopter, now long since solved. Early on the SH-3A helicopters had a problem, now corrected, called "Tail Rotor Buzz". Occasionally there would be a vibration which the pilots could feel in the pedals and hear (hence the buzz). In most cases it would go away, but occasionally there would be a "Bang" and the tail rotor would shed three blade pockets behind the leading edge spar, leaving the tail rotor at 2/5 capacity. The aircraft would spin to the right and crash. Investigations over the years indicated that a right front quartering wind of 15 to 25 Kt (well within the envelope) was where this problem was encountered. Initial indications were that the root end of the blade was hitting the flap-stop (going inboard) and bending. Sikorsky asserted that it was impossible at 100 % rpm for the blade to contact the flapping stop. and so it was, based on the normal 2 dimensional airfoil section data. Wind Tunnel test results, as I remember, at University of Cambridge, England, from an oscillating airfoil showed that m Dynamic Stall" (See Prouty's "Maximum Thrust", August 1999 Rotor and Wing) rotor section lift coefficients (CL) could be substantially higher than the static CL maximum. Although Prouty does not mention the words "Dynamic Stall", it is identical to his Figure 3 (Lift Overshoot due to Rapid Change of Angle of Attack) and can go from a 1.1 maximum statically, to a maximum of about 3.0 dynamically, or almost three times the maximum lift coefficient that the designers contemplated in the original design. Sikorsky decided that could run the blades into the stop.

DTIC

Vibration; Tail Rotors; Wind Tunnel Tests; Sh-3 Helicopter; Flapping

20000055610 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Emerging Technologies in Aircraft Crashworthiness

Schoenbeck, Ann; Schultz, Michael; May 1999; 9p; In English

Report No.(s): AD-A375738; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The U.S. Navy is addressing the primary causes of severe injury and death in survivable military helicopter mishaps through advancing crashworthiness technology. Computer simulation for both aircraft and occupant dynamics has been useful in defining the ideal crashworthy systems. Greater use of simulation is being employed to understand a wide range of crashworthiness-related areas. For example, the effects of a water impact on an aircraft structure are being evaluated, effects of occupant restraint system geometry are being analyzed, and the performance limitations on supplemental restraint systems can be determined. Advances in crash sensor technology has made it possible to integrate supplemental restraint systems into aircraft while adding a capability to record crash impact pulses. An increased awareness of occupant accommodation has brought about novel approaches for crashworthiness for an expanded anthropometric range for systems such as energy absorbers on crew and troop seats.

DTIC

Aircraft Accidents; Aircraft Structures; Anthropometry; Computerized Simulation; Crashworthiness; Military Helicopters

20000055611 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
NAVAIR Perspective on Corrosion Prevention and Control
Spadafora, Stephen; Jan. 2000; 13p; In English
Report No.(s): AD-A375736; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Corrosion damage to naval aircraft is a leading cost driver to NAVAIR, which has increased dramatically over the last decade. A major contributing factor to this is the severe corrosive Navy carrier operational environment. Further complicating this issue is the significant aging of the fleet as well as the higher strength materials fused for naval aviation due to the carrier landing loads. Finally, increasing environmental and safety restrictions, which limit traditional corrosion control materials, combined with the above, make corrosion a significant factor in NAVAIR's aging aircraft. The Command has initiated a Team wide Aircraft Corrosion Control and Prevention Program to actively address the leading MMH/FH cost drivers and investigate more effective corrosion prevention materials. In addition, concepts such as the integrated maintenance concept (IMC) and condition based maintenance (CBM) will facilitate the use of corrosion prevention and control measures that minimize total ownership costs (TOC) and downtime.
DTIC
Corrosion Prevention; Aircraft Maintenance; Composite Materials; Aircraft Carriers

20000056075 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia
Development of a Stress Transfer Function for an Idealized Helicopter Structure
Polanco, Frank G., Defence Science and Technology Organisation, Australia; March 2000; 76p; In English
Report No.(s): DSTO-RR-0171; AR-011-237; Copyright; Avail: Issuing Activity

This report presents an investigation of the effects that may have an influence on the development of a linear stress transfer function (STF) relating the stress in dynamic components to the stress in static components. Effects such as buckling, nonuniqueness, vibration, and solution procedure are considered. Two procedures for determining the STF are compared, one termed the vector procedure and the other the matrix procedure. A simple two dimensional truss, which models an idealised helicopter structure, is constructed to numerically simulate the development of a STF. Using random inputs the resulting stresses are evaluated exactly. Noise is then added to both the input loads and output stresses to develop a noisy data set. Using this noisy data set, STFs are developed using both the vector and matrix techniques. The vector procedure is shown to be sensitive to collinearity in the input, while the matrix technique is found to be more stable under the same ill-conditioning.
Author
Investigation; Research and Development; Linear Vibration; Vibration Mode; Stress Functions; Stress Analysis

20000056200 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Design, Analysis and Optimization of Composite Wings. Implementation of a Composite Wing Sizing Routine in a Multi-Discipline Optimization Program
vanDam, G. P.; Feb. 1999; 136p; In English
Report No.(s): PB2000-103705; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the improvements made on the composite wing sizing routines of the Multi Model Generator, which is part of the MDO program ('Multi-Discipline Design, Analysis and Optimization of Aerospace vehicles'). The design, analysis and optimization of a composite wing structure will be discussed, together with the implementation of the routines in the Multi Model Generator. The new composite wing sizing routines are, compared to the old ones, more flexible and accurate, handle more design variables and create results that are more realistic, taking into account static and static aeroelastic loads, reparability, manufacturing, structural stability, damage tolerance, and aeroelastic effects.
NTIS
Wings; Design Analysis; Aircraft Design; Composite Structures

20000056601 Defence Science and Technology Organisation, Air Operations Div., Fishermens Bend, Australia
A Correlation Between Flight-Determined Longitudinal Derivatives and Ground-Based Data for the Pilatus PC 9/A Training Aircraft in Cruise Configuration
Snowden, Andrew D., Defence Science and Technology Organisation, Australia; Keating, Hilary A., Defence Science and Technology Organisation, Australia; vanBronswijk, Nick, Defence Science and Technology Organisation, Australia; Drobik, Jan S., Defence Science and Technology Organisation, Australia; February 2000; 44p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-0937; AR-011-205; Copyright; Avail: Issuing Activity

A series of flight tests were conducted on the PC 9/A aircraft, A23-045, at the Royal Australian Air Force's Aircraft Research and Development Unit. System identification techniques were applied to the data obtained from these flight tests to determine

the stability and control derivatives of the aircraft. The longitudinal results for the aircraft in cruise configuration are presented in this report and comparisons are made with empirical and ground based estimates.
Author
Derivation; Training Aircraft; Flight Tests; Aircraft Control; Aerodynamic Configurations; Data Processing

20000056622 Technische Hogeschool, Dept. of Aerospace Engineering, Delft, Netherlands
Design of the Wing of a Regional Airliner in Composite Material
Ithurbure, R. P.; Feb. 1999; 194p; In English
Report No.(s): PB2000-103718; No Copyright; Avail: National Technical Information Service (NTIS)

Nowadays, virtually all of the primary structure of larger civil aircraft is made of aluminum alloys. However, the everlasting search for lighter structures is leading to the application of different materials. It is not unforeseeable that the next generation of larger aircraft will have a fuselage of Glare and a wing structure of composites. Composite materials have the advantage, in comparison to conventional aluminum alloys, that they have a low density, and a high strength and stiffness. There are also possible advantages in production and durability. of course, there are also disadvantages. The damage tolerance of composites is lower than that of metals. Usually, damage tolerance is the restricting factor when designing with composites. This means that in a first phase strain limitations are used instead of stress limitations, which are used when designing aluminum alloy structures. The section of the wing designed in this report is that of the 'Garteur G-70' aircraft. It is a transport aircraft for 70 passengers. Hopefully, the results of this report will give a good indication how composite wings of all larger aircraft should be designed.
NTIS
Wings; Composite Structures; Aircraft Design

20000056669 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Development of an Advanced Energy Absorber
Richards, Marvin K.; Podob, Roger; Oct. 21, 1999; 10p; In English
Report No.(s): AD-A375734; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The attenuation of vertical impact forces in helicopter mishaps is one of the prime factors in determining survivability. Within the cockpit, energy-absorbing crewseats have made significant improvements in helicopter crash survival. The first crashworthy crewseats used fixed-load energy absorbers (EA's) to limit the load on the occupant's spine. These EA's were not adjustable and stroked at a factory-established, constant load through their entire operating range. Energy absorbers (also known as energy attenuators or load limiters) were then developed with a provision for manually adjusting the load so that a wide range of occupants would have equal protection in a crash. An EA load is selected that is proportional to the occupant's weight so that each occupant will experience similar acceleration and use similar stroking space in a crash. This technology was applied in programs to retrofit new seats into the U.S. Navy's CH-53 Sea Stallion and SH-3 Sea King aircraft. Work is currently underway to produce the next-generation energy absorber. The improved EA must be able to perform several functions. It must exhibit a load-deflection curve that produces the most efficient operation within the limits of human tolerance and within the limited vertical space available in military helicopters. It must also provide equal protection for the entire aircrew population, from the smallest female to the largest male. The efforts to date have produced very promising results. This paper summarizes the development of the advanced energy absorber stroking profile and the seat dynamic test results.
DTIC
Absorbers (Materials); Crashworthiness; Energy Absorption; H-53 Helicopter; Human Tolerances; Sh-3 Helicopter

20000057146 Michigan Univ., Dept. of Mechanical Engineering and Applied Mechanics, Ann Arbor, MI USA
Shape Control of Adaptive Structures Using Compliant Mechanisms *Final Report, 1 Jun. 1996-31 Oct. 1999*
Kota, Sridhar; Mar. 24, 2000; 8p; In English
Contract(s)/Grant(s): F49620-96-1-0205; AF Proj. 2302
Report No.(s): AD-A376131; AFRL-SR-BL-TR-00-0125; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A methodology for designing compliant mechanisms for a given static shape change task has been developed. In this methodology, given two different shapes the synthesis program automatically generates the form (topology, size and shape) of an optimized compliant mechanism which is actuated by minimum number of actuators (typically one). The energy from the actuator is transferred via compliant mechanism to deform one given shape into another desired shape. The basic premise is to distribute the actuation energy of remote acutator via compliant transmission (distributed compliance) instead of using a plethora of actuators (distributed actuation systems).
DTIC
Shape Control; Actuators; Airfoils; Wings; Aircraft Design; Smart Structures

20000057229 NASA Langley Research Center, Hampton, VA USA

The Application of the NFW Design Philosophy to the HSR Arrow Wing Configuration

Bauer, Steven X. S., NASA Langley Research Center, USA; Krist, Steven E., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 597-639; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Natural Flow Wing design philosophy was developed for improving performance characteristics of highly-swept fighter aircraft at cruise and maneuvering conditions across the Mach number range (from Subsonic through Supersonic). The basic philosophy recognizes the flow characteristics that develop on highly swept wings and contours the surface to take advantage of those flow characteristics (e.g., forward facing surfaces in low pressure regions and aft facing surfaces in higher pressure regions for low drag). Because the wing leading edge and trailing edge have multiple sweep angles and because of shocks generated on nacelles and diverters, a viscous code was required to accurately define the surface pressure distributions on the wing. A method of generating the surface geometry to take advantage of those surface pressures (as well as not violating any structural constraints) was developed and the resulting geometries were analyzed and compared to a baseline configuration. This paper will include discussions of the basic Natural Flow Wing design philosophy, the application of the philosophy to an HSCT vehicle, and preliminary wind-tunnel assessment of the NFW HSCT vehicle.

Author

Aerodynamic Configurations; Aircraft Design; Arrow Wings; Flow Characteristics; Supersonic Transports

20000057230 NASA Langley Research Center, Hampton, VA USA

Analysis and Inverse Design of the HSR Arrow Wing Configuration with Fuselage, Wing, and Flow Through Nacelles

Krist, Steven E., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Pt. 2, pp. 641-664; In English; See also 20000057219; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The design process for developing the natural flow wing design on the HSR arrow wing configuration utilized several design tools and analysis methods. Initial fuselage/wing designs were generated with inviscid analysis and optimization methods in conjunction with the natural flow wing design philosophy. A number of designs were generated, satisfying different system constraints. of the three natural flow wing designs developed, the NFWAc2 configuration is the design which satisfies the constraints utilized by McDonnell Douglas Aerospace (MDA) in developing a series of optimized configurations; a wind tunnel model of the MDA designed OPT5 configuration was constructed and tested. The present paper is concerned with the viscous analysis and inverse design of the arrow wing configurations, including the effects of the installed diverters/nacelles. Analyses were conducted with OVERFLOW, a Navier-Stokes flow solver for overset grids. Inverse designs were conducted with OVERDISC, which couples OVERFLOW with the CDISC inverse design method. An initial system of overset grids was generated for the OPT5 configuration with installed diverters/nacelles. An automated regridding process was then developed to use the OPT5 component grids to create grids for the natural flow wing designs. The inverse design process was initiated using the NFWAc2 configuration as a starting point, eventually culminating in the NFWAc4 design-for which a wind tunnel model was constructed. Due to the time constraints on the design effort, initial analyses and designs were conducted with a fairly coarse grid; subsequent analyses have been conducted on a refined system of grids. Comparisons of the computational results to experiment are provided at the end of this paper.

Author

Aerodynamic Configurations; Aircraft Design; Design Analysis; Aircraft Configurations; Applications Programs (Computers); Computational Fluid Dynamics; Grid Generation (Mathematics)

20000057253 Boeing Commercial Airplane Co., Seattle, WA USA

Overview of CA Activities at Boeing

Kulfan, Robert M., Boeing Commercial Airplane Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 777-785; In English; See also 20000057252; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

The Configuration Aerodynamics technology development activities consist of four primary subtasks. These include: 1) Non-linear rigid and aeroelastic methods adaption and validation; 2) Developing and validation of non-linear aerodynamic design optimization capability; 3) Nacelle design and airframe integration studies; 4) Assessments of the baseline TCA configuration and determining the benefits of the Configuration Aerodynamics technology development activities. Descriptions of Boeing's involvement in these subtasks are presented.

Derived from text

Aerodynamic Configurations; Design Analysis; Aircraft Design

20000057254 Boeing Co., Seattle, WA USA

TCA Configuration Cruise Point Design Optimization

Wittenberg, K. R., Boeing Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 786-870; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

The 1996 objective was to produce and validate a non-linear CFD design, at the TCA cruise point, which met project constraints and yielded a reasonable drag reduction. The optimization was to be based upon the linear-design TCA configuration. The approach is to limit the design space through implementation of both the specified project constraints plus other geometric constraints which past experience had shown to be effective in ushering the design toward acceptable geometry. The method permits emphasis on acceptable geometric solutions. by attending to the locations of active constraints, we may still choose to compromise on the constraints for more attractive possible solutions. The TRANAIR code was chosen as the optimization tool. This selection was made for several reasons. First, TRANAIR has repeatedly demonstrated that the full potential equation contains all the physics, except viscosity, necessary to accurately calculate the flow about the supersonic cruise point of efficient HSCT configurations. Integrated forces, in particular drag, are accurately predicted. Second, the optimization implementation is very efficient. Finally, the ability to handle arbitrary geometry allows accurate and faithful representation of as much of the configuration as desired.

Derived from text

Computational Fluid Dynamics; Design Analysis; Optimization; Aircraft Design; Aerodynamic Configurations; Aerodynamic Drag

20000057255 Boeing Co., Seattle, WA USA

Observations on the Process and Results of Optimization

Conner, R. S., Boeing Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 871-968; In English; See also 20000057252; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

The smoothing process will be described and some visual examples of the results of the activity will be shown. This is followed by a discussion of the constraint behavior of the optimization. Active and inactive constraints are listed and some interesting examples are shown. The next section illustrates the effect of optimization on the spanwise aerodynamic properties of the TCA configuration. It is prefaced with the effects of nacelle/diverters on the TCA. The report concludes with a broad discussion of some of the drag reduction mechanisms which appear to be exploited by the optimization. Examples of each mechanism are given.

Derived from text

Aircraft Design; Optimization; Aerodynamic Characteristics; Aerodynamic Configurations

20000057256 DYNACS Engineering Co., Inc., Renton, WA USA

Transonic Flap Optimization at Flight Reynolds Number

Kandula, Max, DYNACS Engineering Co., Inc., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp. 969-1071; In English; See also 20000057252; No Copyright; Avail: CASI; A06, Hardcopy; A10, Microfiche

The objective of this task is to conduct a parametric viscous Computational Fluid Dynamics Analysis (CFD) study of Ref. H and TCA wing/body configurations at flight Reynolds number. Optimum outboard wing leading edge (LE) and trailing edge (TE) flap settings at transonic cruise (M=0.9) and acceleration (M= 1.1) will be determined by independently varying the flap deflections. The flight Reynolds numbers Re (based on mean aerodynamic chord) for the Ref. H are 171E6 at M=0.9 and 190E6 at M=1.1, and those for the TCA are 164E6 at M=0.9 and 301E6 at M=1.1. Another objective of the work is to understand the transonic flowfield at flight Reynolds number, including leading edge vortex and flow separation about the hinge line and the trailing edge flap.

Derived from text

Body-Wing Configurations; Computational Fluid Dynamics; Separated Flow; Trailing Edge Flaps; Transonic Flight; Leading Edge Flaps

20000057258 Boeing Co., Seattle, WA USA

Nacelle/Diverter Design and Airframe Integration

Chaney, Steve, Boeing Co., USA; Blom, Gordon, Boeing Co., USA; McMahon, Steve, Boeing Co., USA; Ogg, Steve, Boeing Co., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance; December 1999; Volume 1, Part 2, pp.

1092-1190; In English; See also 20000057252; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

The primary objective for propulsion/airframe integration (PAI) work stated in the planning and control document (PCD) is to develop technology required to support the development of the High Speed Civil Transport (HSCT). The technology development includes: 1) Developing computational and empirical based tools for the aerodynamic design & analysis of complex geometry configurations. This development consists primarily of adapting current state-of-the-art computational fluid dynamics (CFD) codes to the HSCT PAI configurations and conditions. This is followed by validation with wind tunnel or flight aerodynamic data; 2) Identifying the key design variables for HSCT PAI installations with the tools described above. Exercising these variables in parametric or direct design optimization studies in order to develop design guidelines for efficient nacelle installations.

Derived from text

Computational Fluid Dynamics; Design Analysis; Engine Airframe Integration; Supersonic Transports; Aerodynamic Configurations; Applications Programs (Computers)

20000057416 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

Failure Criterion for the Skin-Stiffener Interface in Composite Aircraft Panels

vanRijn, J. C. F. N.; Jun. 10, 1998; 40p; In English; Original contains color illustrations

Report No.(s): PB2000-104924; NLR-TP-98264; No Copyright; Avail: National Technical Information Service (NTIS)

In numerous panel tests it was established that, in the post-buckling regime, failure of a composite stiffened panel is often induced by failure of a skin-stiffener interface. The present paper describes recent and on-going research performed at the National Aerospace Laboratory NLR, which aims at the derivation of a failure criterion for stiffener pop-off. The strip specimens used in the present investigation consisted of a tapered stiffener flange bonded on a skin laminate. The specimens were loaded in four-point bending. It was established that there was no significant influence of the stiffness properties of the flange laminate on the skin-stiffener interface strength. The strength of the skin-stiffener interface was governed by the deformation of the skin only. NTIS

Stiffness; Aircraft Structures; Skin (Structural Member); Interfaces; Composite Structures; Structural Failure

20000057432 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA

Phase II Demonstration Test of the Electromagnetic Reverberation Characteristics of a Large Transport Aircraft *Final Report*

Johnson, D. M.; Hatfield, Michael O.; Slocum, MichaelB.; Sep. 1997; 199p; In English

Report No.(s): AD-A376368; NSWCDD/TR-97/84; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This report describes the second phase of an investigation into the electromagnetic characterization of a typical large commercial aircraft. The test aircraft, the same one used for the Phase I test, was a decommissioned Boeing 707-720B. A major objective was a comparison of data obtained with band-limited white Gaussian noise (BLWGN) excitation and data obtained with continuous wave (CW) excitation and mechanical mode-mixing. Five aircraft areas were instrumented with probes. A common test article (CTA), developed by Naval Surface Warfare Center, Dahlgren Division, was tested in several locations in the cockpit and avionics bay. Test areas were excited from 100 MHz to 6 GHz using discrete or swept-frequency CW signals. Aluminum foil tuners provided mode-mixing. Normalized cavity power density was the ratio of received power to input power. Stirring ratios in several areas were determined and limited cavity-to-cavity coupling was measured. Power received by instrumented boxes and the CTA was measured using discrete and swept-frequency CW. Mode-mixing for the areas excited with BLWGN was in 2-, 10-, and 50-MHz bandwidths; four measurements were obtained for each cavity, frequency span, and bandwidth combination. Pulse decay measurements provided a direct measurement of the cavity quality factor (Q). External excitation from three aspect angles provided external-to-internal shielding effectiveness (SE) measurements. Limited narrow pulsewidth external and internal excitation of two areas was performed. Time domain analysis of received power yielded external-to-internal SE and cavity Q. DTIC

Electromagnetic Properties; Electromagnetic Radiation; Reverberation; Wave Excitation; Transport Aircraft; Continuous Radiation

20000057459 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Next Generation Instrumentation Bus Test Plan for Fibre Channel

Jones, Sid; Sep. 30, 1999; 25p; In English

Report No.(s): AD-A376558; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This test plan describes the test objectives, test elements, and methods for achieving the objectives. The test objectives and elements are identified to level that is considered reasonably for the evaluation of Fibre Channel as a communication bus for flight test instrumentation applications.
DTIC
Flight Test Instruments; Channels (Data Transmission); Communication Equipment; Fibers

20000057468 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands
Influence of Stitching Fibre and Stitching Density on the Failure Strains of CFRP Fabrics
Thuis, H. G. S. J.; Werzberg, I.; Loh, A.; Bannister, M. K.; Jan. 1998; 22p; In English; Composite Materials ECCM-8, 3-6 Jun. 1998, Napels, Italy
Report No.(s): PB2000-104920; NLR-TP-98022; No Copyright; Avail: National Technical Information Service (NTIS)
In this paper, the results are described of an experimental program in which the influence of stitching fiber and stitching density on the failure strains of carbon fiber fabric/epoxy laminates, impregnated by Resin Transfer Molding (RTM), was investigated by carrying out static compression and tension tests. The results were compared to results of typical unidirectional prepreg specimens made in the autoclave. The compression tests revealed that stitching did not result in a significant improvement of allowable strain levels, due to the presence of circumferential roving reinforcements in the RTM fabric. The compression after impact tests showed that failure strain levels for stitched and unstitched RTM specimens are almost equal to failure strain levels for autoclave specimens. A stitching density of 4 stitches/sq cm will result in a small reduction of tension failure strain. The stitching fiber type, Kevlar of Dyneema, has no influence on the failure strain levels.
NTIS
Fibers; Failure Analysis; Sewing; Carbon Fiber Reinforced Plastics

20000057469 National Aerospace Lab., Informatics Div., Amsterdam Netherlands
Embedding Safety Critical Software in an Airframe
Kesseler, E.; vandeSluis, E.; May 1998; 28p; In English; Embedded Systems, 19 May 1998, Eindhoven, Netherlands
Report No.(s): PB2000-104919; NLR-TP-98163; No Copyright; Avail: National Technical Information Service (NTIS)
Aircraft are highly adaptable to accommodate the large requirement variety from the very diverse group of aircraft operators. Consequently the adaptability of (embedded) software is appreciated. In the application discussed, the safety of the aircraft depends on the correct functioning of the embedded software. In order not to compromise on safety, strict development procedures have to be adhered to. This is ensured by an independent governmental authority which certifies the embedded software as fit-for-use, i.e. airworthy. Based on practical experience, the way the airworthiness and the requirement volatility influence the embedded software development is discussed.
NTIS
Software Engineering; Computer Programs; Embedding; Flight Safety; Software Reliability

20000057527 Naval Postgraduate School, Monterey, CA USA
An Analysis of Operational Availability of Brazilian Navy and Argentine Air Force A-4 Fleets Using Simulation Modeling
Rodrigues, Marcelo B.; Karpowicz, Mario; Dec. 1999; 96p; In English
Report No.(s): AD-A376396; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This thesis analyzes the impact of reducing transportation cycle time and consolidating aviation electronic component inventory management on the operational availability of the Brazilian Navy and Argentine Air Force AA fleets. The research is based on a scenario where the Brazilian Navy operates twenty A-4 aircraft, while the Argentine Air Force operates thirty AAs, and both countries rely on manufacturers in the USA for depot-level maintenance. The transportation turn-around-time is extremely long and the cost of some inventory items is very high. A simulation model was developed representing the repair process of a selected group of A4 critical electronic components. This particular model provides an effective managerial resource for long-term decision making to improve the readiness of aircraft fleet for both countries. We also developed a multiple regression analysis model (metamodel) to find the relationship between spare inventory levels and the operational availability. These results were applied to a linear programming model to find optimal spare levels for these critical components by minimizing the total cost while maintaining the desirable military readiness. Through a cost-effectiveness analysis, we compared the two situations, optimal spare levels with reduced transportation time and actual spare level with current transportation time. Our research concludes that both Armed Forces will improve readiness, while achieving significant savings, if they reduce the transportation

time for the aviation electronic components sent to the USA for depot-level maintenance, and collaborate on the inventory management of their A-4 fleets.
DTIC
Attack Aircraft; Aircraft Maintenance; Mathematical Models; Military Operations; A-4 Aircraft; Armed Forces (Foreign); Avionics; Regression Analysis

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

20000048495 National Aerospace Lab., Informatics Div., Amsterdam, Netherlands
Reliability, Maintainability and Safety Applied to a Real World Avionics Application
Kessler, E., National Aerospace Lab., Netherlands; vandeSluis, E., National Aerospace Lab., Netherlands; Jan. 1998; 28p; In English; European Safety and Reliability Conference, 17-19 Jun. 1998, Trondheim, Norway
Report No.(s): PB2000-104661; NLR-TP-98037; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

NLR currently is co-developing a civil avionics application that connects aircraft subsystems with the aircraft flight deck by means of modern digital data buses. It combines, controls, processes, and forwards the data between the subsystems and the flight deck. For this kind of application, certification is required by an independent, government-authorized third party. Guidelines for this certification are documented in the DO-178B standard: Software considerations in airborne systems and equipment certification. This paper describes practical experiences with DO-178B. The software development methodology used to guarantee the reliability, maintainability, safety, and certifiability of the product in a commercial environment is discussed. Requirements volatility and short time-to-market characterize the commercial reality.
NTIS
Avionics; Reliability Analysis; Maintainability; Flight Safety

20000048618 Analytic Sciences Corp., Reading, MA USA
Advanced Avionics Verification and Validation Phase 2 (AAV&V-II) ***Final Report, 1 Dec. 1994-1 Jan. 1999***
Cook, Robert E., Jr; Jan. 1999; 138p; In English
Contract(s)/Grant(s): F33615-92-D-1052; AF Proj. 3090
Report No.(s): AD-A375862; TR-06664-3; AFRL-IF-WP-TR-2000-1502; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

PROBLEM STATEMENT: As the complexity of software projects for embedded avionics applications increases, it becomes increasingly obvious that new innovative techniques will have to be used to help test those projects. Current methods of testing often require man-in-the-loop as well as extensive set up times. Often, the verification and validation of moderate software changes requires several weeks of man hours to accomplish. Advanced Avionics Verification and Validation (AAV&V) as an innovative technique: The AAV&V addresses the above problem by providing software developers and testers access to current testing a project technologies while investigating and proposing new techniques for validation and verification. Current software developers and testers can take advantage of an AAV&V Tool which sets on a powerful engineering workstation with open system architecture and gives them coverage and static analysis capability as well as documentation access and generation. Future software developers and testers will enjoy expansion of language options on the AAV&V tool's front end, as well as access to Formal Methods and Statistical techniques.
DTIC
Computer Programs; Avionics; Static Tests; Proving; Applications Programs (Computers); Workstations; Statistical Analysis

20000052120 NASA Dryden Flight Research Center, Edwards, CA USA
Development of a Flush Airdata Sensing System on a Sharp-Nosed Vehicle for Flight at Mach 3 to 8
Davis, Mark C., NASA Dryden Flight Research Center, USA; Pahle, Joseph W., NASA Dryden Flight Research Center, USA; White, John Terry, NASA Dryden Flight Research Center, USA; Marshall, Laurie A., NASA Dryden Flight Research Center, USA; Mashburn, Michael J., Micro Craft, Inc., USA; Franks, Rick, Sverdrup Technology, Inc., USA; January 2000; 18p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 522-51-54-00-50

Report No.(s): H-2390; AIAA Paper 2000-0504; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Dryden Flight Research Center has developed a flush airdata sensing (FADS) system on a sharp-nosed, wedge-shaped vehicle. This paper details the design and calibration of a real-time angle-of-attack estimation scheme developed to meet the onboard airdata measurement requirements for a research vehicle equipped with a supersonic-combustion ramjet engine. The FADS system has been designed to perform in flights at Mach 3-8 and at -6 deg - 12 deg angle of attack. The description of the FADS architecture includes port layout, pneumatic design, and hardware integration. Predictive models of static and dynamic performance are compared with wind-tunnel results across the Mach and angle-of-attack range. Results indicate that static angle-of-attack accuracy and pneumatic lag can be adequately characterized and incorporated into a real-time algorithm.
Author

Air Data Systems; Wind Tunnel Tests; Wind Tunnel Models; Supersonic Wind Tunnels; Detection; Remote Sensing; Indicating Instruments

20000052481 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

Automatic In-Flight Data Acquisition System for the RNLN Lynx Helicopter

Vergroesen, A. L.; Hoek, P. R.; Carati, F. J.; Dominicus, J. A. J. A.; ten Have, A. A.; Feb. 1998; 24p; In English; 19th; Aircraft Integrated Monitoring Systems AIMS98, 4-7 May 1998, Garmisch, Germany

Report No.(s): PB2000-103819; NLR-TP-98079; No Copyright; Avail: National Technical Information Service (NTIS)

As part of a maintenance cost reduction policy, the Royal Netherlands Navy (RNLN) recently funded the development, acquisition, certification, and the fleetwide installation of a unique multi-channel on-board data-acquisition system for its Lynx helicopter, called AIDA (Automatic In-flight Data Acquisition). This 17-channel AIDA system will generate valuable RNLN Lynx usage and loads data on the main rotor, engines, and airframe, thus enabling the RNLN to optimize Lynx maintenance until the NH90 comes into full service and the Lynx fleet will be phased out. Apart from a technical description of the AIDA system, the paper describes how a relatively small operator, such as the RNLN, performed the rather complex AIDA development program by itself.
NTIS

Data Acquisition; Automatic Control

20000052931 National Aerospace Lab., Informatics Div., Amsterdam, Netherlands

Avionics Application Development, Coalesce Certifiability with Business Opportunity

Kesseler, E.; vandeSluis, E.; Jun. 1998; 26p; In English; Presented at DASIA '98, Data System in Aerospace Conference, Athens, Greece, May 25-28, 1998

Report No.(s): PB2000-104921; NLR-TP-98282; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To fly aircraft under all (adverse) conditions, pilots must fully rely on the data presented to them, and on the correct and timely forwarding of their commands to the relative aircraft subsystems. The avionics application discussed connects these subsystems with the aircraft flight deck by means of modern digital data buses. It combines, controls processes and forwards the data between the subsystems and the flight deck. to protect the interests of the general public, an independent governmental authority certifies the avionics application as fit for use i.e. airworthy. In this paper the experiences with the software development methods to meet this requirements are presented. Based on metrics for several key process areas of Capability Maturity Model, the influence of current engineering on the software development is discussed.
NTIS

Avionics; Certification; Software Engineering; Quality Control; Product Development; Channels (Data Transmission); Digital Data

20000053516 National Aerospace Lab., Div. of Electronics and Instrumentation, Amsterdam, Netherlands

Avionics Development in a Concurrent Engineering Environment, from Virtual Prototyping to Testing

Aartman, L. J., National Aerospace Lab., Netherlands; Eveleens, L. C., National Aerospace Lab., Netherlands; Wellink, S., National Aerospace Lab., Netherlands; Jul. 1998; 30p; In English; 5th; European Concurrent Engineering Conference, 26-29 Apr. 1998, Erlangen-Nuremberg, Germany

Report No.(s): PB2000-103817; NLR-TP-98135; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Avionics product development is a multi-disciplinary activity carried out by multiple design groups and often distributed over several companies. The avionics products are usually composed of multiple hardware and software elements. by improving

system specification and requirements verification techniques, early shortcomings (thus future problems) can be avoided. Early verification therefore is important as a quality objective and early prototyping has become an important means to achieve this.
NTIS
Avionics; Concurrent Engineering; Product Development; Systems Engineering; Software Engineering; Functional Design Specifications

20000053518 National Aerospace Lab., Amsterdam, Netherlands
Instrumentation for the ESA Parafoil Technology Demonstrator Test
Klijn, J. M., National Aerospace Lab., Netherlands; Jun. 1998; 26p; In English; 10th; SFTE European Chapter Symposium, 15-17 Jun. 1998, Linkoeping, Sweden; Sponsored by Fokker B.V., Netherlands
Contract(s)/Grant(s): FFS-PTD-95/185-NL/PL
Report No.(s): PB2000-103815; NLR-TP-98241; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Parafoil Technology Demonstrator (PTD) program was set up to demonstrate the feasibility to guide a large scale parafoil autonomously to a predefined point and to perform a flared landing within a specific range. Another objective was to enable further investigation into the flight dynamics of the parafoil system. The program was conducted under the responsibility of the European Space Agency (ESA) and carried out by DASA Ottobrun. The instrumentation consisted of various sensors of which the data was collected by a data acquisition system. The data acquisition system distributed the data to other data subsystems like a data recorder, telemetry system, and an on-board computer system. This computer system primarily took care of the Guidance, Navigation, and Control (GNC) function of the PTTV and for this purpose, it controlled the trailing edge deflection of the parafoil by providing data to an actuator system. This paper mainly focuses on the requirements, design, and performance of the instrumentation system of the PTTV. In addition, some attention is given to the overall system architecture and the conducted flight test program.
NTIS
Flight Test Vehicles; Technology Feasibility Spacecraft; Navigation Instruments; Flight Test Instruments; Technology Assessment

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

20000052721 Universal Technology Corp., Dayton, OH USA
High Cycle Fatigue Science and Technology Program 1999 Annual Report *Annual Report, 1 Jan.-31 Dec. 1999*
Jan. 2000; 154p; In English
Contract(s)/Grant(s): F33615-98-C-2807; AF Proj. 3066
Report No.(s): AD-A375702; AFRL-PR-WP-TR-2000-2004; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This third annual report of the National Turbine Engine High Cycle Fatigue (HCF) Program is a brief review of work completed, work in progress, and technical accomplishments. This program is a coordinated effort with participation by the Air Force, the Navy, and NASA. The technical efforts are organized under eight Action Teams including: Materials Damage Tolerance Research, Forced Response Prediction, Component Analysis, Instrumentation, Passive Damping Technology, Component Surface Treatments, Aeromechanical Characterization, and Engine Demonstration. Daniel E. Thomson, AFRL/PRTC, Wright-Patterson AFB, is the Program Manager.
DTIC
Aircraft Engines; Fatigue (Materials); Tolerances (Mechanics); Turbine Engines; Fatigue Tests; Damage

20000054672 NASA Glenn Research Center, Cleveland, OH USA
The NPARC Alliance Verification and Validation Archive
Slater, John W., NASA Glenn Research Center, USA; Dudek, Julianne C., NASA Glenn Research Center, USA; Tatum, Kenneth E., Sverdrup Technology, Inc., USA; April 2000; 14p; In English; 2000 Fluids Engineering Summer Conference, 11-15 Jun. 2000, Boston, MA, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 714-04-50
Report No.(s): NASA/TM-2000-209946; NAS 1.15:209946; E-12196; ASME-2000-FED-11233; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NPARC Alliance (National Project for Applications oriented Research in CFD) maintains a publicly-available, web-based verification and validation archive as part of the development and support of the WIND CFD code. The verification and validation methods used for the cases attempt to follow the policies and guidelines of the ASME and AIAA. The emphasis is on air-breathing propulsion flow fields with Mach numbers ranging from low-subsonic to hypersonic.
Author
Computational Fluid Dynamics; World Wide Web; Data Bases; Proving; Acceptability

20000054673 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands
Non Destructive Investigation of the Condition of Gas Turbine Blades
Kolkman, H. J.; Kool, G. A.; Jan. 1998; 28p; In English; Original contains color illustrations
Report No.(s): PB2000-104890; NLR-TP-98013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to determine the remaining life of service exposed turbine blades, it is necessary to characterize the degeneration of the microstructure of the base metal during service. Since turbine blades of industrial gas turbines are kept in complete stages, non-destructive inspection (NDI) is very attractive. Hence the goal of the investigation to was to evaluate a NDI technique able to detect microstructural changes of the base metal. It was found that single-stage replication (in combination with investigation in a Scanning Electron Microscope) is a relatively simple technique that fulfils all requirements. This technique can be used in-situ on uncoated buckets. For coated turbine blades, local removal of the coating is necessary to perform base metal replication.
NTIS
Turbine Blades; Gas Turbine Engines; Nondestructive Tests; Degradation; Service Life; Heat Resistant Alloys

20000054684 Institute for Human Factors TNO, Soesterberg, Netherlands
Innovation of the Curriculum of the F-16 Aircraft Engine Maintenance Engineers: Differentiation of the Training Program and Specification of the Training Devices ***Final Report Innovatie van de Opleiding tot F-16 Motormonteur: Differentiatie van het Opleidingstraject en Specificatie van Onderwijsleermiddelen***
vandenBosch, K., Institute for Human Factors TNO, Netherlands; vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; May 01, 1998; 30p; In English
Contract(s)/Grant(s): A95/KLu/368; TNO Proj. 790.2
Report No.(s): TD-98-0035; TM-98-A026/E; Copyright; Avail: Issuing Activity

The Royal Netherlands Air Force has commissioned the TNO Human Factors Research Institute to conduct a study into the innovation of the training of the F-16 engine maintenance technicians. The immediate reason for this research project is the lack of adequate training devices at the Air Force Electronics and Technical School. A first analysis disclosed a second problem: an inadequate attunement between the contents of the training course and the skills required by the Air Force bases. In order to tackle the identified problems, the tasks of the F-16 engine maintenance technicians are subjected to a thorough analysis. Based on the results the necessary training devices are identified, and a differentiated training program is proposed. The results of previous phases are described in intermediate reports (Van Berlo & Van den Bosch, 1996; Van Berlo, Van den Bosch, Kanis, & Zwartscholten, 1996; Schaafstal & Van Berlo, 1996). This fourth and final report contains the results of the design phase. The previously proposed differentiated training program is modified into to a two-track training program. The basis of this differentiation is whether the engine is part of the aircraft or has been disassembled. This new structure has several advantages: (1) the training course is better attuned to the operational practice, (2) to a certain degree personnel can still be assigned in a flexible way, and (3) there are ample opportunities for synchronizing theoretical and practical lessons with the term of practical work on the job. An inventory is made up of the required (technologically advanced) training devices. Five categories of tasks are identified that can not be (adequately) addressed in the current training program due to the lack of (proper) training devices. Based on an analysis of the skills, a training analysis and identification of training scenarios, the functional specifications for the training devices have been formulated describing the level of modelling and the instructional features. The differentiated structure of the training program, the learning objectives and the specified training devices are integrated in a rough blueprint of the training course. It is indicated which modules are identified and which training methods are required. It is concluded that the suggestions proposed in the present report can produce significant improvements in training effectiveness and training efficiency, with minor concessions regarding operational flexibility.
Author
F-16 Aircraft; Aircraft Engines; Functional Design Specifications; Aircraft Maintenance; Maintenance Training

20000054869 NASA Glenn Research Center, Cleveland, OH USA
Tribological Limitations in Gas Turbine Engines: A Workshop to Identify the Challenges and Set Future Directions
DellaCorte, Chris, NASA Glenn Research Center, USA; Pinkus, Oscar, Mohawk Innovative Technology, Inc., USA; May 2000;

70p; In English; Tribological Limitations in Gas Turbine Engines, 15-17 Sep. 1999, Albany, NY, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 523-18-13
Report No.(s): NASA/TM-2000-210059; E-12261; NAS 1.15:210059; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The following report represents a compendium of selected speaker presentation materials and observations made by Prof O. Pinkus at the NASA/ASME/Industry sponsored workshop entitled "Tribological Limitations in Gas Turbine Engines" held on September 15-17, 1999 in Albany, New York. The impetus for the workshop came from the ASME's Research Committee on Tribology whose goal is to explore new tribological research topics which may become future research opportunities. Since this subject is of current interest to other industrial and government entities the conference received cosponsorship as noted above. The conference was well attended by government, industrial and academic participants. Topics discussed included current tribological issues in gas turbines as well as the potential impact (drawbacks and advantages) of future tribological technologies especially foil air bearings and magnetic beatings. It is hoped that this workshop report may serve as a starting point for continued discussions and activities in oil-free turbomachinery systems.
Author
Turbomachinery; Tribology; Gas Turbines

20000055604 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Tribological Limitations in Gas Turbine Engines. A Workshop to Identify the Challenges and Set Future Directions
Grant, Darrell; Sep. 1999; 19p; In English
Report No.(s): AD-A375759; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Early in the development of the gas turbine aircraft engine, tribology played a key supporting role in extending the life and performance of oil lubricated rolling element bearings permitting operation at ever higher speeds, loads and temperatures. A major factor in the success of rolling element bearings has been a clear understanding of the operating conditions and improvements in both bearing materials and lubricants. However, current projections and recent experience are that advancements to existing bearings and lubricants will likely only be incremented at best.
DTIC
Gas Turbine Engines; Lubricants; Tribology; Roller Bearings

20000056610 NASA Lewis Research Center, Cleveland, OH USA
Study of Boundary Layer Development in a Two-Stage Low-Pressure Turbine
Dorney, Daniel J., Virginia Commonwealth Univ., USA; Ashpis, David E., NASA Lewis Research Center, USA; Halstead, David E., General Electric Co., USA; Wisler, David C., General Electric Co., USA; [1998]; 10p; In English
Contract(s)/Grant(s): NCC3-645; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row (wake) interactions and separation can have a significant impact on the efficiency of turbine stages. The effects of these interactions can be intensified in low-pressure turbine stages because of the low Reynolds number operating environment. Measured turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Thus, during the last decade a significant amount of effort has been put into determining the effects of transition and turbulence on the performance of low pressure turbine stages. Experimental investigations have been performed, for example, by Hodson et al. and Halstead et al. These investigations have helped identify/clarify the roles that factors such as the Reynolds number, free stream turbulence intensity, pressure gradient and curvature have in the generation of losses. In parallel to the experimental investigations, there have been significant analytical efforts to improve the modeling of transition. Examples of such efforts include the works of Mayle and Gostelow et al. These newer models show promise of providing accurate transition predictions over a wide range of flow conditions, although they have yet to be implemented into the numerical flow analyses used by the turbine design community. Some recent computational investigations of interest include the works of Chernobrovkin and Lakshminarayana and Eulitz and Engel. The focus of the current effort has been to -use a viscous, unsteady quasi-three-dimensional Navier-Stokes analysis to study boundary layer development in a two-stage low-pressure turbine. A two-layer algebraic turbulence model, along with a natural transition model and a bubble transition model, have been used, The geometry used in the simulations has been the subject of extensive experiments. The predicted results have been compared with experimental data, including airfoil loadings and time-averaged/unsteady integral boundary layer quantities.
Author
Research; Boundary Layers; Low Pressure; Two Stage Turbines; Wakes; Simulation; Mathematical Models; Engine Tests

20000056874 NASA Glenn Research Center, Cleveland, OH USA

NASA Aviation Safety Program Aircraft Engine Health Management Data Mining Tools Roadmap

Litt, Jonathan, NASA Glenn Research Center, USA; Simon, Donald L., NASA Glenn Research Center, USA; Meyer, Claudia, DYNACS Engineering Co., Inc., USA; DePold, Hans, Pratt and Whitney Aircraft, USA; Curtiss, Russell, Pratt and Whitney Aircraft, USA; Winston, Howard, United Technologies Research Center, USA; Wang, Yao, Caelum Research Corp., USA; Statler, Irv, NASA Ames Research Center, USA; Gawdiak, Yuri, NASA Ames Research Center, USA; April 2000; 14p; In English; 14th; Aerospace/Defense Sensing, Simulation and Controls AeroSense, 24-28 Apr. 2000, Orlando, FL, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): RTOP 577-10-10; DA Proj. 1L1-61102-AH-45

Report No.(s): NASA/TM-2000-210030; E-12227; NAS 1.15:210030; ARL-TR-2213; SPIE-4057-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aircraft Engine Health Management Data Mining Tools is a project led by NASA Glenn Research Center in support of the NASA Aviation Safety Program's Aviation System Monitoring and Modeling Thrust. The objective of the Glenn-led effort is to develop enhanced aircraft engine health management prognostic and diagnostic methods through the application of data mining technologies to operational data and maintenance records. This will lead to the improved safety of air transportation, optimized scheduling of engine maintenance, and optimization of engine usage. This paper presents a roadmap for achieving these goals. Author

Aircraft Safety; Aircraft Engines; Flight Safety; Maintenance; Management Methods

20000056989 NASA Glenn Research Center, Cleveland, OH USA

Heat Transfer and Flow on the Squealer Tip of a Gas Turbine Blade

Azad, Gm S., Texas A&M Univ., USA; Han, Je–Chin, Texas A&M Univ., USA; Boyle, Robert J., NASA Glenn Research Center, USA; [2000]; 8p; In English; ASME Turbo 2000, 8-11 May 2000, Munich, Germany; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): NAG3-2002; RTOP 523-26-13

Report No.(s): ASME Paper-2000-FT-0195; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Experimental investigations are performed to measure the detailed heat transfer coefficient and static pressure distributions on the squealer tip of a gas turbine blade in a five-bladed stationary linear cascade. The blade is a 2-dimensional model of a modem first stage gas turbine rotor blade with a blade tip profile of a GE-E(sup 3) aircraft gas turbine engine rotor blade. A squealer (recessed) tip with a 3.77% recess is considered here. The data on the squealer tip are also compared with a flat tip case. All measurements are made at three different tip gap clearances of about 1%, 1.5%, and 2.5% of the blade span. Two different turbulence intensities of 6.1% and 9.7% at the cascade inlet are also considered for heat transfer measurements. Static pressure measurements are made in the mid-span and near-tip regions, as well as on the shroud surface opposite to the blade tip surface. The flow condition in the test cascade corresponds to an overall pressure ratio of 1.32 and an exit Reynolds number based on the axial chord of 1.1 x 10(exp 6). A transient liquid crystal technique is used to measure the heat transfer coefficients. Results show that the heat transfer coefficient on the cavity surface and rim increases with an increase in tip clearance. 'Me heat transfer coefficient on the rim is higher than the cavity surface. The cavity surface has a higher heat transfer coefficient near the leading edge region than the trailing edge region. The heat transfer coefficient on the pressure side rim and trailing edge region is higher at a higher turbulence intensity level of 9.7% over 6.1 % case. However, no significant difference in local heat transfer coefficient is observed inside the cavity and the suction side rim for the two turbulence intensities. The squealer tip blade provides a lower overall heat transfer coefficient when compared to the flat tip blade.
Author

Heat Transfer; Heat Transfer Coefficients; Static Pressure; Pressure Distribution; Pressure Measurement

20000057037 NASA Glenn Research Center, Cleveland, OH USA

Noise Reduction Potential of Large, Over-the-Wing Mounted, Advanced Turbofan Engines

Berton, Jeffrey J., NASA Glenn Research Center, USA; April 2000; 18p; In English; 14th; 14th International Symposium on Air Breathing Engines, 5-10 Sep. 1999, Florence, Italy

Contract(s)/Grant(s): RTOP 714-99-20

Report No.(s): NASA/TM-2000-210025; NAS 1.15:210025; E-12222; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As we look to the future, increasingly stringent civilian aviation noise regulations will require the design and manufacture of extremely quiet commercial aircraft. Indeed, the noise goal for NASA's Aeronautics Enterprise calls for technologies that will help to provide a 20 EPNdB reduction relative to today's levels by the year 2022. Further, the large fan diameters of modem,

increasingly higher bypass ratio engines pose a significant packaging and aircraft installation challenge. One design approach that addresses both of these challenges is to mount the engines above the wing. In addition to allowing the performance trend towards large, ultra high bypass ratio cycles to continue, this over-the-wing design is believed to offer noise shielding benefits to observers on the ground. This paper describes the analytical certification noise predictions of a notional, long haul, commercial quadjet transport with advanced, high bypass engines mounted above the wing.
Author
Noise Reduction; Aircraft Noise; Engine Noise; Noise Prediction (Aircraft)

20000057150 Naval Academy, Annapolis, MD USA
Improved Turbine Blade Cooling Using Endwall Flow Modifications. A Trident Scholar Project Report, No. 260
Aunapu, Nicole V.; May 05, 1999; 91p; In English
Report No.(s): AD-A376183; USNA-TR-260,(1999); No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A flow modification technique designed to allow increased turbine inlet temperatures while keeping the turbine blades below their thermal limits is introduced. A large-scale two-half-blade cascade simulator is used to model the secondary flow between two adjacent turbine blades. Various flow visualization techniques and measurements are used to verify that the test section replicates the flow of an actual turbine engine. Two techniques are employed to modify the endwall secondary flow by altering the flow characteristics, specifically the path of the horseshoe vortex. Five wall jets are installed at a location downstream of the saddle point near the leading edge of the pressure side blade. These wall jets, near the saddle point, are found to be ineffective in diverting the path of the horseshoe vortex. The second technique utilizes a row of 12 centerline wall jets whose positions are based on results from a modified fence. The row of jets have successfully diverted the path of the horseshoe vortex and decreased its effect on the suction side blade. This can be expected to increase the effectiveness of film cooling in that area. However, the row of jets increased the aerodynamic losses in the turbine passage, which would result in a decrease of turbine efficiency.
DTIC
Film Cooling; Turbine Blades; Flow Visualization; Secondary Flow; Gas Turbine Engines; Horseshoe Vortices; Wall Jets

20000057171 SRI International Corp., Menlo Park, CA USA
Fractographic Analysis of High-Cycle Fatigue in Aircraft Engines *Final Report, 15 Jul. 19998-31 Dec. 1999*
Shockey, Donald A.; Kobayashi, Takao; Saito, Naoki; Aubry, Jean–Marie; Grunbaum, Alberto; Jan. 2000; 124p; In English
Contract(s)/Grant(s): F49620-98-C-0041
Report No.(s): AD-A376120; SRI-2478; AFRL-SR-BL-TR-00-0117; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A seedling program was conducted to determine whether load information is stored in the fracture surface features of failed aircraft components and, if so, to explore methods for extracting this information. Fracture surfaces produced under systematically varied cyclic load conditions in laboratory specimens of titanium turbine blade alloy were provided to the program by an aircraft engine manufacturer. Three-dimensional topographys of the surfaces were obtained via confocal optics and microscopy and analyzed with Fourier and wavelet techniques. Both analysis techniques confirmed the existence of load information in the fracture surface topography. Moreover, correlation was found between Fourier results and fatigue load parameters. The topographic characterization and analysis method was then applied to an F-118 engine component that had cracked in service to determine whether the load history that caused the cracking could be extracted. Using the results from the laboratory specimens as a reference database, the method provided a quantitative estimate of an influential fatigue load parameter and indicated its variation with crack growth distance.
DTIC
Aircraft Engines; Fractography; Topography; Fatigue (Materials); Fracturing

20000057336 Toledo Univ., OH USA
Advanced Propulsion System Studies in High Speed Research *Final Report*
Zola, Charles L., Toledo Univ., USA; April 2000; 48p; In English
Contract(s)/Grant(s): NCC3-193; RTOP 714-01-4A
Report No.(s): NASA/CR-2000-210035; E-12233; NAS 1.26:210035; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Propulsion for acceptable supersonic passenger transport aircraft is primarily impacted by the very high jet noise characteristics of otherwise attractive engines. The mixed flow turbofan, when equipped with a special ejector nozzle seems to be the best candidate engine for this task of combining low jet noise with acceptable flight performance. Design, performance, and operation aspects of mixed flow turbofans are discussed. If the special silencing nozzle is too large, too heavy, or not as

effective as expected, alternative concepts in mixed flow engines should be examined. Presented herein is a brief summary of efforts performed under cooperative agreement NCC3-193. Three alternative engine concepts, conceived during this study effort, are herein presented and their limitations and potentials are described. These three concepts intentionally avoid the use of special silencing nozzles and achieve low jet noise by airflow augmentation of the engine cycle.
Author
Noise Measurement; Flight Characteristics; Multiphase Flow; Air Flow; Propulsion System Performance; Low Noise; Jet Aircraft Noise

20000057396 NASA Glenn Research Center, Cleveland, OH USA
Longitudinal-Mode Combustion Instabilities: Modeling and Experiments
Cohen, J. M., United Technologies Research Center, USA; Hibshman, J. R., United Technologies Research Center, USA; Proscia, W., United Technologies Research Center, USA; Rosfjord, T. J., United Technologies Research Center, USA; Wake, B. E., United Technologies Research Center, USA; McVey, J. B., jbScienceS, USA; Lovett, J., Pratt and Whitney Aircraft, USA; Ondas, M., Pratt and Whitney Aircraft, USA; DeLaat, J., NASA Glenn Research Center, USA; Breisacher, K., NASA Glenn Research Center, USA; May 2000; 18p; In English; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles, 8-11 May 2000, Braunschweig, Germany; Sponsored by North Atlantic Treaty Organization
Contract(s)/Grant(s): RTOP 523-26-13
Report No.(s): NASA/TM-2000-210067; E-12316; NAS 1.15:210067; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Combustion instabilities can lead to increased development time and cost for aeroengine gas turbines. This problem has been evident in the development of very-low emissions stationary gas turbines, and will likely be encountered in the newer, more aggressive aeroengine designs. In order to minimize development time and cost, it is imperative that potential combustion dynamics issues be resolved using analyses and smaller-scale experimentation. This paper discusses a methodology through which a problem in a full-scale engine was replicated in a single-nozzle laboratory combustor. Specifically, this approach is valid for longitudinal and "bulk" mode combustion instabilities. An explanation and partial validation of the acoustic analyses that were used to achieve this replication are also included. This approach yields a testbed for the diagnosis of combustion dynamics problems and for their solution through passive and active control techniques.
Author
Longitudinal Stability; Combustion Stability; Combustion Chemistry; Combustion; Combustion Control; Engine Control; Aircraft Engines

20000057399 NASA Glenn Research Center, Cleveland, OH USA
Numerical Zooming Between a NPSS Engine System Simulation and a One-Dimensional High Compressor Analysis Code
Follen, Gregory, NASA Glenn Research Center, USA; auBuchon, M., Pratt and Whitney Aircraft, USA; April 2000; 20p; In English; Computational Aerosciences, 15-17 Feb. 2000, Moffett Field, CA, USA
Contract(s)/Grant(s): NAS3-98005; RTOP 509-10-31
Report No.(s): NASA/TM-2000-209913; E-12144; NAS 1.15:209913; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Within NASA's High Performance Computing and Communication (HPCC) program, NASA Glenn Research Center is developing an environment for the analysis/design of aircraft engines called the Numerical Propulsion System Simulation (NPSS). NPSS focuses on the integration of multiple disciplines such as aerodynamics, structures, and heat transfer along with the concept of numerical zooming between zero-dimensional to one-, two-, and three-dimensional component engine codes. In addition, the NPSS is refining the computing and communication technologies necessary to capture complex physical processes in a timely and cost-effective manner. The vision for NPSS is to create a "numerical test cell" enabling full engine simulations overnight on cost-effective computing platforms. of the different technology areas that contribute to the development of the NPSS Environment, the subject of this paper is a discussion on numerical zooming between a NPSS engine simulation and higher fidelity representations of the engine components (fan, compressor, burner, turbines, etc.). What follows is a description of successfully zooming one-dimensional (row-by-row) high-pressure compressor analysis results back to a zero-dimensional NPSS engine simulation and a discussion of the results illustrated using an advanced data visualization tool. This type of high fidelity

system-level analysis, made possible by the zooming capability of the NPSS, will greatly improve the capability of the engine system simulation and increase the level of virtual test conducted prior to committing the design to hardware.
Author
Computerized Simulation; Systems Simulation; Computer Techniques; High Pressure; Compressors; Systems Analysis; Computer Systems Programs; Computer Programming

20000057404 NASA Lewis Research Center, Cleveland, OH USA
Study of Low Reynolds Number Effects on the Losses in Low-Pressure Turbine Blade Rows
Dorney, Daniel J., General Motors Inst., USA; Ashpis, David E., NASA Lewis Research Center, USA; June 1998; 16p; In English; 34th; Joint Propulsion, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG3-1668; RTOP 522-31-23
Report No.(s): AIAA Paper 98-3575; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row interactions and separation can have a significant impact on the efficiency of low-pressure turbine stages. Measured turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Several recent studies have revealed that Reynolds number effects may contribute to the lower efficiencies at cruise conditions. In the current study numerical experiments have been performed to study the models available for low Reynolds number flows, and to quantify the Reynolds number dependence of low-pressure turbine cascades and stages. The predicted aerodynamic results exhibit good agreement with design data.
Author
Low Reynolds Number; Turbine Blades; Engine Tests; Jet Engines; Flow Velocity

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots.

20000044874 Boeing Commercial Airplane Co., Seattle, WA USA
Critical Stability and Control Issues in High-Speed Aerodynamics for the HSCT
Wilson, Douglas L., Boeing Commercial Airplane Co., USA; Princen, Norman H., McDonnell-Douglas Aerospace, USA; Harris, Oran C., Lockheed Martin Aeronautical Systems Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1215-1231; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The stability and control issues in high speed aerodynamics of most significance for the development of a viable HSCT are identified, and the status of the Ref. H configuration with respect to these issues is discussed. The interdependence between aerodynamic requirements and assumptions about airplane system functions such as Envelope Protection and Integrated Flight/Propulsion Control is highlighted. The conclusions presented draw on results from the Ref. H Assessment and Alternate Control Concepts Assessment performed under Configuration Aerodynamics Subtask 5 during 1995.
Author
Aircraft Stability; Aerodynamic Stability; Controllability; Aircraft Control; Flight Characteristics; Aerodynamic Configurations; Aerodynamics; Control Theory

20000044875 NASA Langley Research Center, Hampton, VA USA
An Experimental Database for Conventional and Alternate Control Concepts on the HSR 1.675% Reference H Model
McMillin, Naomi, NASA Langley Research Center, USA; Allen, Jerry, NASA Langley Research Center, USA; Erickson, Gary, NASA Langley Research Center, USA; Campbell, Jim, NASA Langley Research Center, USA; Mann, Mike, NASA Langley Research Center, USA; Kubiatko, Paul, McDonnell-Douglas Aerospace, USA; Yingling, David, McDonnell-Douglas Aerospace, USA; Mason, Charlie, Lockheed Martin Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1233-1251; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The objective was to experimentally evaluate the longitudinal and lateral-directional stability and control characteristics of the Reference H configuration at supersonic and transonic speeds. A series of conventional and alternate control devices were also

evaluated at supersonic and transonic speeds. A database on the conventional and alternate control devices was to be created for use in the HSR program.
Derived from text
Lateral Stability; Longitudinal Stability; Directional Stability; Flight Control; Flight Characteristics

20000044876 NASA Langley Research Center, Hampton, VA USA
High Reynolds Number Effects on HSCT Stability and Control Characteristics
Elzey, Michael B., Boeing Co., USA; Owens, Lewis R., Jr., NASA Langley Research Center, USA; Wahls, Richard A., NASA Langley Research Center, USA; Wilson, Douglas L., Boeing Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1253-1284; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Two wind tunnel tests during 1995 in the National Transonic Facility (NTF 070 and 073) served to define Reynolds number effects on longitudinal and lateral-directional stability and control. Testing was completed at both high lift and transonic conditions. The effect of Reynolds number on the total airplane configuration, horizontal and vertical tail effectiveness, forebody chine performance, rudder control and model aeroelastics was investigated. This paper will present pertinent stability and control results from these two test entries. Note that while model aeroelastic effects are examined in this presentation, no corrections for these effects have been made to the data.
Derived from text
Wind Tunnel Tests; Transonic Wind Tunnels; High Reynolds Number; Lateral Stability; Longitudinal Stability; Directional Stability; Controllability; Aircraft Control

20000045996 McDonnell-Douglas Aerospace, Long Beach, CA USA
Reference H Cycle 3 Stability, Control, and Flying Qualities Batch Assessments
Henderson, Dennis K., McDonnell-Douglas Aerospace, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 441-476; In English; See also 20000045988
Contract(s)/Grant(s): NAS1-20220; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This work is an update of the assessment completed in February of 1996, when a preliminary assessment report was issued for the Cycle 2B simulation model. The primary purpose of the final assessment was to re-evaluate each assessment against the flight control system (FCS) requirements document using the updated model. Only a limited number of final assessments were completed due to the close proximity of the release of the Langley model and the assessment deliverable date. The assessment used the nonlinear Cycle 3 simulation model because it combines nonlinear aeroelastic (quasi-static) aerodynamic with hinge moment and rate limited control surface deflections. Both Configuration Aerodynamics (Task 32) and Flight Controls (Task 36) were funded in 1996 to conduct the final stability and control assessments of the unaugmented Reference H configuration in FY96. Because the two tasks had similar output requirements, the work was divided such that Flight Controls would be responsible for the implementation and checkout of the simulation model and Configuration Aerodynamics for writing Madab "script' files, conducting the batch assessments and writing the assessment report. Additionally, Flight Controls was to investigate control surface allocations schemes different from the baseline Reference H in an effort to fulfill flying qualities criteria.
Derived from text
Flight Characteristics; Flight Control; Control Stability; Aerodynamic Configurations; Wind Tunnel Tests; Civil Aviation

20000046621 Simtec, Inc., Manassas, VA USA
Development and Validation of a Method of Evaluating the Effectiveness of Fighter Aircraft Simulation Force Cueing Devices *Final Report, 3 Jun. 1996 - 1 Oct. 1997*
Heintzman, Richard J., Simtec, Inc., USA; Basinger, James D., Aeronautical Systems Div., USA; Middendorf, Matthew, Middendorf Technical Services, USA; May 1999; 58p; In English
Contract(s)/Grant(s): F33657-94-D-2253
Report No.(s): AD-A375328; ASC-TR-2000-5001; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report documents the study which developed a method for evaluating the effectiveness of various force cueing devices a flight simulator. The concept developed included measurement of pilot behavior, performance, physiology and subjective pilot opinion to evaluate system effectiveness. As a part of this study, a trial evaluation was conducted in a laboratory fighter simulator to validate the evaluation method including identifying which pilot behaviors could best be measured and how the data could be collected and analyzed. Five task scenarios were flown by experienced fighter pilots with and without the presence of force cueing. Control activity and vehicle state data were analyzed to examine the effects of force cueing on pilot performance and control behavior. A debriefing questionnaire was used to elicit the pilot's subjective evaluation. The results of the trial evaluation indicated

that the presence of force cueing improved pilot performance, control behavior, and made the simulator more operationally realistic.
DTIC
Pilot Performance; Flight Simulation; Flight Simulators; Cues

20000046788 NASA Dryden Flight Research Center, Edwards, CA USA
Emergency Control Aircraft System Using Thrust Modulation
Burken, John J., Inventor, NASA Dryden Flight Research Center, USA; Burcham, Frank W., Jr., Inventor, NASA Dryden Flight Research Center, USA; Mar. 21, 2000; 8p; In English
Patent Info.: Filed 1 Jul. 1997; NASA-Case-DRC-09600-7; US-Patent-6,041,273; US-Patent-Appl-SN-886656; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A digital longitudinal Aircraft Propulsion Control (APC system of a multiengine aircraft is provided by engine thrust modulation in response to comparing an input flightpath angle signal (gamma)c from a pilot thumbwheel. or an ILS system with a sensed flightpath angle y to produce an error signal (gamma)e that is then integrated (with reasonable limits) to generate a drift correction signal to be added to the error signal (gamma)e after first subtracting a lowpass filtered velocity signal Vel(sub f) for phugoid damping. The output error signal is multiplied by a constant to produce an aircraft thrust control signal ATC of suitable amplitude to drive a throttle servo for all engines. each of which includes its own full-authority digital engine control (FADEC) computer. An alternative APC system omits sensed flightpath angle feedback and instead controls the flightpath angle by feedback of the lowpass filtered velocity signal Vel(sub f) which also inherently provides phugoid damping. The feature of drift compensation is retained.
Official Gazette of the U.S. Patent and Trademark Office
Aircraft Control; Electronic Control; Engine Control; Error Signals; Feedback Control

20000048496 National Aerospace Lab., Amsterdam, Netherlands
Stochastic Simulation Procedure Compared to Deterministic Methods for PSD Gust Design Loads
Vink, W. J., National Aerospace Lab., Netherlands; May 1998; 94p; In English
Report No.(s): PB2000-104663; NLR-TP-98240; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This report presents results of a study into PSD gust design load calculation methods. A Stochastic Simulation procedure based on the probability of exceeding the design level is developed. The probability of design level eccedence is equal for linear and nonlinear aircraft systems, so that the method produces the equivalent design conditions for linear and nonlinear systems. The Stochastic Simulation procedure is defined such, that estimations for the attained accuracy can be given. The results with Stochastic Simulation are compared to Deterministic PSD methods that have been studied in previous phases of this project. The MFB and the IDPSD methods produce results that approach the Stochastic Simulation results in some way, however there are still significant differences. The SG method results deviate considerably from the results of the other Deterministic methods as well as from Stochastic Simulation results.
NTIS
Power Spectra; Gust Loads; Stochastic Processes; Computerized Simulation; Research; Atmospheric Models

20000051546 TZN Forschungs- und Entwicklungszentrum Unterluess G.m.b.H., Germany
The Development of Multiple Supersonic Hot Gas Actuators for Missile Control
Meuer, Rosemarie, TZN Forschungs- und Entwicklungszentrum Unterluess G.m.b.H., Germany; Rosner, Norbert, TZN Forschungs- und Entwicklungszentrum Unterluess G.m.b.H., Germany; Schwenzer, Michael, TZN Forschungs- und Entwicklungszentrum Unterluess G.m.b.H., Germany; Small Rocket Motors and Gas Generators for Land, Sea and Air Launched Weapon Systems; April 2000, pp. 17-1 - 17-12; In English; See also 20000051537; Copyright Waived; Avail: CASI; A03, Hardcopy

A system of bistable or quasi-tristable fluidic jet reaction control elements could provide a reliable and effective means of missile control. A single solid fuelled motor is used to supply typically four fluidic elements, which are mounted at right angles to each other. A single bistable element, for example, delivers a fixed amount of thrust, which can be directed in one of two channels whose outlets axes are also at an angle of 901. The motor continuously supplies a thrust vector, which is switched from one canal to the other on the order of a few milliseconds using a relatively small jet pulse injected into the main flow. The jet injection can be easily controlled using two fast reacting magnetic valves. The present study involves experimental measurements of a fluidic actuator, which are compared to CFD results. The experiments were carried out in two stages. First, the experimental models were tested using gaseous nitrogen as the main flow. This not only allowed longer and repeated testing over the entire range of operating conditions, but also permitted visual access to the flowfield. The final short duration tests involve the use of a solid

propellant to supply the main flow. After an optimisation of the element shape and the magnetic valves a complete jet reaction control system shall be demonstrated. The application of such a system is useful for guided high speed projectiles and missiles. The schedule to develop a demonstrator for a significantly enhanced existing system will be 3 years.
Author
High Temperature Gases; Actuators; Control Valves; Missile Control

20000051547 Thiokol Propulsion, Brigham City, UT USA
COMPACT THRUST VECTOR CONTROL FOR SMALL TACTICAL MOTORS
Wassom, Steven R., Thiokol Propulsion, USA; Behring, Michael A., Thiokol Propulsion, USA; Schroeder, Rich, Versatron Corp., USA; Small Rocket Motors and Gas Generators for Land, Sea and Air Launched Weapon Systems; April 2000, pp. 21-1 - 21-8; In English; See also 20000051537; Copyright Waived; Avail: CASI; A02, Hardcopy

Focused efforts are underway to develop a control system for high-agility air-to-air missiles that combines conventional 4-fin aerodynamic control with dual movable nozzles for 3-axis control in all flight regimes. Packaging and performance will be demonstrated with a static test on a 7-inch diameter rocket motor. This system advance builds on 3 key technologies: miniature temperature-insensitive flexible bearings (flexbearings), a compact electromechanical actuation system, and a unique mechanical linkage that couples the motions of the nozzles and aerodynamic surfaces. Two separate nozzle/blast tube assemblies integrated into a common motor closure allow for the most efficient packaging of the actuation system. The estimated improvements compared to a current production type 3-axis control system are as follows: length, 49%; weight, 29%; delivered impulse, 16%; mass fraction, 16%; and cost, is greater than 50%. A new 3.5-year program funded through the IHPRPT process is furthering development efforts.
Author
Thrust Vector Control; Air to Air Missiles; Space Weapons; Missile Control; Rocket Engines

20000052124 NASA Langley Research Center, Hampton, VA USA
Fin Buffeting Features of an Early F-22 Model
Moses, Robert W., NASA Langley Research Center, USA; Huttsell, Lawrence, Air Force Research Lab., USA; [2000]; 10p; In English; 41st; Structures, Structural Dynamics, and Materials, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1695; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Fin buffeting is an aeroelastic phenomenon encountered by high performance aircraft, especially those with twin vertical tails that must operate at high angles of attack. This buffeting is a concern from fatigue and inspection points of view. to date, the buffet (unsteady pressures) and buffeting (structural response) characteristics of the F-15 and F/A-18 fins have been studied extensively using flow visualization, flow velocity measurements, pressure transducers, and response gages. by means of windtunnel and flight tests of the F-15 and F/A-18, this phenomenon is well studied to the point that buffet loads can be estimated and fatigue life can he increased by structural enhancements to these airframes. However, prior to the present research, data was not available outside the F-22 program regarding fin buffeting on the F-22 configuration. During a test in the Langley Transonic Dynamics Tunnel, flow visualization and unsteady fin surface pressures were recorded for a 13.3%-scale F-22 model at high angles of attack for the purpose of comparing with results available for similar aircraft configurations. Details of this test and fin buffeting are presented herein.
Author
Buffeting; Aeroelasticity; Aircraft Configurations; Angle of Attack; Leading Edges; Rudders; Fins; Tail Assemblies; Leading Edge Flaps

20000052722 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Modular Control Design for the Innovative Control Effectors (ICE) Tailless Fighter Aircraft Configuration 101-3 ***Final Report, 1 May 1997-1 May***
Buffington, James; Jun. 1999; 152p; In English
Contract(s)/Grant(s): Proj-2304
Report No.(s): AD-A375713; AFRL-VA-WP-TR-1999-3057; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A modular flight control system is developed for a tailless fighter aircraft with innovative control effectors. Dynamic inversion control synthesis is used to develop a full envelope flight control law, Minor dynamic inversion command variable revisions are required due to the tailless nature of the configuration studied to achieve nominal stability and performance. Structured singular value and simulation analysis shows that robust stability is achieved and robust performance is slightly

deficient due to modeling errors. A multi-branch linear programming-based method is developed and used for allocation of redundant limited control effectors.
DTIC
Flight Control; Control Equipment; Aircraft Configurations; Tailless Aircraft

20000053161 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany
The Interaction of Flight Control System and Aircraft Structure
Becker, J., Daimler-Benz Aerospace A.G., Germany; Caldwell, B., British Aerospace Aircraft Group, UK; Vaccaro, V., Alenia Aeronautica, Italy; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 4-1 - 4-11; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Results from structural coupling investigations are presented which include the design and verification of structural filters for a flight control system. The advantages of an integrated interdisciplinary flight control system (FCS) design on the basis of the coupled dynamic model of the structural dynamic model and the flight dynamic model of the aircraft are described. The design strategy of the Flight Control System development is improved through the integrated design optimisation procedure which includes the modelling of the coupled system of the flight dynamics, the structural dynamics, the actuators and sensors as well as the effects of the digital system. Different examples are demonstrated which document the advantages of the integrated, interdisciplinary design. Methods to avoid structural mode-flight interaction are described. Especially the design of filters to minimise interaction is outlined, which is based upon a model of the aircraft describing the coupled flight dynamic flight control dynamics and structural dynamic behaviour and on ground and in flight structural coupling tests. The paper explains design procedures, design and clearance requirements, correlation between model predictions and structural coupling tests and model update for on ground and in flight.
Author
Control Systems Design; Dynamic Characteristics; Dynamic Models; Dynamic Structural Analysis; Flight Control; Optimization; Aircraft Structures

20000053166 Dassault Aviation, Saint-Cloud, France
Flutter Analysis Method in Presence of Mechanical Play and Experimental Verification ***Methode de Calcul du Flutter en Presence de Jeu Mecanique et Verification Experimentale***
Petiau, C., Dassault Aviation, France; Journee, B., Dassault Aviation, France; Garrigues, E., Dassault Aviation, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 9-1 - 9-16; In French; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Flutter analysis in presence of mechanical play occurs in the certification of fail-safe linkage of Falcon horizontal stabilizer. The corresponding calculation method has been developed in our ELFINI software, if is based on: a Finite Element Structural dynamics model, a time domain model of unsteady aerodynamics (Karpel type), an implicit time integration, and the resolution of play/contact by an algorithm derived from quadratic optimization techniques. We expose the experimental verification methodology with dynamic model in wind tunnel, in 3 steps: definition, preliminary calculations, sizing of experience for checking observability of studied phenomena, verification, calibration of structural F.E. model with static and vibration tests, of aerodynamic model with steady and unsteady pressure measurements, comparison of calculated/measured critical flutter speeds with fixed contact, flutter calculation calibrated structural and aerodynamic models, the simulation reproduces test results both qualitatively (damped behaviour, limit cycles, divergence) and quantitatively (acceleration levels).
Author
Dynamic Models; Dynamic Response; Dynamic Structural Analysis; Finite Element Method; Flutter Analysis; Mathematical Models; Flight Simulation; Aircraft Design

20000053167 Aerospatiale Matra Airbus, Toulouse, France
An Integrated Process for Design and Validation of Flight Control Laws of Flexible Aircraft Structure
Lacabanne, Michel, Aerospatiale Matra Airbus, France; Humbert, Marc, Aerospatiale Matra Airbus, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 9bis-1 - 9bis-6; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper recalls some problems which need to be carefully studied in relation with flexibility of large transport aircraft and control laws design. The evolution of flexible aircraft models is described, and it is shown that the evolution of the Flight Control System (FCS) design process is coming along with more interdisciplinary models. The FCS validation process is supported by

models, and by flight tests. The need to perform an in flight identification of structural modes is explained, as well as the methodology which could be used for future very large transport aircraft.
Author
Control Systems Design; Flight Control; Very Large Transport Aircraft; Aeroservoelasticity; Aircraft Structures; Systems Integration; Dynamic Models

20000053173 NASA Langley Research Center, Hampton, VA USA
NASA Langley Research Center's Contributions to International Active Buffeting Alleviation Programs
Moses, Robert W., NASA Langley Research Center, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 15-1 - 15-9; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Buffeting is an aeroelastic phenomenon which plagues high performance aircraft, especially those with twin vertical tails like the F/A-18, at high angles of attack. This buffeting is a concern from fatigue and inspection points of view. by means of wind-tunnel and flight tests, this phenomenon is well studied to the point that buffet loads can be estimated and fatigue life can be increased by structural enhancements to the airframe. In more recent years, buffeting alleviation through active control of smart materials has been highly researched in wind-tunnel proof-of-concept demonstrations and full-scale ground tests using the F/A-18 as a test bed. Because the F/A-18 resides in fleets outside as well as inside the USA, these tests have evolved into international collaborative research activities with Australia and Canada, coordinated by the Air Force Research Laboratory (AFRL) and conducted under the auspices of The Technical Cooperation Program (TTCP). With the recent successes and advances in smart materials, the main focus of these buffeting alleviation tests has also evolved to a new level: utilize the F/A-18 as a prototype to mature smart materials for suppressing vibrations of aerospace structures. The role of the NASA Langley Research Center (LaRC) in these programs is presented.
Author
Active Control; Aeroelasticity; Aircraft Structures; Buffeting; Smart Materials; Aerodynamic Stability; NASA Programs

20000053174 Dassault Aviation, Saint-Cloud, France
Method of Mathematical Identification of Unsteady Airloads from Flight Measurements, Experimental Validation
Methode d'Identification des Forces Aerodynamiques Instantionnaires sur les Essais en Vol, Validation Experimentale
Petiau, C., Dassault Aviation, France; Garrigues, E., Dassault Aviation, France; Nicot, Ph., Dassault Aviation, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 16-1 - 16-8; In French; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Since the end of the 70ies we have developed, within the frame of our ELFINI software, original techniques for mathematical model identifications, in particular for calibration of dynamic Finite Element models from ground vibration tests and of steady aeroelastic loads from flight tests. Now we have tackled calibration of unsteady airloads from flight vibration tests. Mathematically speaking, we keep the same approach, which differs notably from classical least square methods (minimization of a calculation-measurement "distance" in function of calibration parameters). We prefer to use a quadratic optimizaton type approach with the minimization of a "distance" between calibration parameters and their theoretical or presumed values, constraining the solution to satisfy measurement reconstitution by the model at a given accuracy. Among advantages of this technique, the principal is to get rid of ill-observable parameters. We describe two applications: (1) Calibration of steady aerodynamic pressure fields from flight measurements of strain-gage responsed in maneuver, illustrated by an example coming from the calibration of Rafale airloads; (2) Calibration of unsteady airloads from wind tunnel measurements, transposable to flight measurements, of frequencies and dampings of aeroelastic dynamic model of an Airbus type stabilizer. We show that critical flutter speed is identified from tests at much lower speed. As a conclusion we present the future prospect for the method.
Author
Parameter Identification; Calibrating; Dynamic Models; Finite Element Method; Aerodynamic Loads; Aeroelasticity

20000053176 Technische Hochschule, Inst. of Flight Mechanics and Control, Stuttgart, Germany
Integrated Flight Mechanic and Aeroelastic Modelling and Control of a Flexible Aircraft Considering Multidimensional Gust Input
Teufel, Patrick, Technische Hochschule, Germany; Hanel, Martin, Technische Hochschule, Germany; Well, Klaus H., Technische Hochschule, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 18-1 - 18-9; In English; See also 20000053157
Contract(s)/Grant(s): FKZ-20A9503G; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper, the influence of gusts on the dynamics of a large flexible aircraft is analyzed, and an integrated flight and aeroelastic control law that reduces gust sensitivity is presented. The calculations are based on an integrated model that includes

all 1st order couplings between flight mechanic and structural degrees of freedom. Uniform, 1-dimensional and multidimensional gust models are implemented and used for gust sensitivity analysis. For the example aircraft, the differences in gust sensitivity calculated with the 1-dimensional and multi-dimensional gust models are significant. Integrated attitude, stability augmentation, and aeroelastic control laws for longitudinal and lateral motion are designed using micro-synthesis. With the control laws, flight maneuvers do not excite elastic reactions, and the sensitivity to gusts is considerably reduced.
Author
Aeroelasticity; Attitude Stability; Flight Mechanics; Stability Augmentation; Gust Loads; Control Theory; Aircraft Models

20000053177 Daimler-Benz Aerospace A.G., Bremen, Germany
Integral Control of Large Flexible Aircraft
Koenig, Klaus, Daimler-Benz Aerospace A.G., Germany; Schuler, Joerg, Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 19-1 - 19-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

In a flexible aircraft flight control, load control and structural mode control interfere with each other. Therefore, an integral design of controller(s) is necessary. This paper describes how an integral aircraft model covering the requirements of all three disciplines can be derived and how an integral controller can be designed by multiobjective parameter optimization. General design criteria for mode control are proposed.
Author
Controllers; Flexible Wings; Flight Control; Control Systems Design; Mathematical Models; Aerodynamic Loads; Transport Aircraft

20000053178 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Robotics and System Dynamics, Wessling, Germany
Design of Control Laws for Alleviation of Ground - Induced Vibrations
Krueger, W. R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kortuem, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 20-1 - 20-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

An aircraft is subject to a great number of different loads during one operational cycle. For the aircraft, not only the flight loads but also the ground loads are of importance. A crucial point is therefore the development of airframe and landing gears in an integrated design process. Semi-active landing gears are able to effectively suppress fuselage vibrations which have been excited by an uneven runway. During the design process of such control structures the dynamics of landing gear and airframe have to be known. At the example of the control design for a semi-active damper it will be shown how existing design tools can be used for the integrated design process. The design process will be described and simulation results for aircraft with semi-active landing gears controlled by a sky-hook controller and a state feedback controller.
Author
Ground Effect (Aerodynamics); Landing Gear; Control Theory; Aerodynamic Loads; Control Systems Design; Structural Vibration; Systems Analysis

20000053182 Office National d'Etudes et de Recherches Aerospatiales, Systems Control and Flight Dynamics Dept., Toulouse, France
An Integrated Methodology for Flexible Aircraft Control Design ***Une Methodologie Globale de Conception de Lois de Commande Pour l'Avion Souple***
Alazard, D., Office National d'Etudes et de Recherches Aerospatiales, France; Bucharles, A., Office National d'Etudes et de Recherches Aerospatiales, France; Ferreres, G., Office National d'Etudes et de Recherches Aerospatiales, France; Magni, J. F., Office National d'Etudes et de Recherches Aerospatiales, France; Prudhomme, S., Office National d'Etudes et de Recherches Aerospatiales, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 25-1 - 25-10; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

This article details recent research activities of the Systems Control and Flight Dynamics department of ONERA in the field of flexible aircraft control. A long-term research program has been conducted for several years, with governmental funds, and with the technical support of AEROSPATIALE-Avions (Toulouse, France). Beyond the primary objectives of achieving various specifications for simultaneous aircraft motion and structural dynamics control, more fundamental questions are addressed, concerning the implications of rigid-structural dynamics coupling for the selection of suitable control law design methodologies.
Author
Aircraft Control; Control Theory; Dynamic Structural Analysis; Control Systems Design; Systems Integration

20000057292 NASA Langley Research Center, Hampton, VA USA
Flight Control Using Distributed Shape-Change Effector Arrays
Raney, David L., NASA Langley Research Center, USA; Montgomery, Raymond C., NASA Langley Research Center, USA; Green, Lawrence I., NASA Langley Research Center, USA; Park, Michael A., Joint Inst. for Advancement of Flight Sciences, USA; [2000]; 13p; In English; 41st; Structures, Structural Dynamics, and Materials Conference and Exhibit, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1560; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent discoveries in material science and fluidics have been used to create a variety of novel effector devices that offer great potential to enable new approaches to aerospace vehicle flight control. Examples include small inflatable blisters, shape-memory alloy diaphragms, and piezoelectric patches that may be used to produce distortions or bumps on the surface of an airfoil to generate control moments. Small jets have also been used to produce a virtual shape-change through fluidic means by creating a recirculation bubble on the surface of an airfoil. An advanced aerospace vehicle might use distributed arrays of hundreds of such devices to generate moments for stabilization and maneuver control, either augmenting or replacing conventional ailerons, flaps or rudders. This research demonstrates the design and use of shape-change device arrays for a tailless aircraft in a low-rate maneuvering application. A methodology for assessing the control authority of the device arrays is described, and a suite of arrays is used in a dynamic simulation to illustrate allocation and deployment methodologies. Although the authority of the preliminary shape-change array designs studied in this paper appeared quite low, the simulation results indicate that the effector suite possessed sufficient authority to stabilize and maneuver the vehicle in mild turbulence.
Author
Shape Memory Alloys; Control Equipment; Flight Control; Shapes; Aerospace Vehicles

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems.

20000046627 Directorate General of Civil Aviation, The Hague, Netherlands
The Integrated Airport Competition Model, 1998
Veldhuis, J., Directorate General of Civil Aviation, Netherlands; Essers, I., Directorate General of Civil Aviation, Netherlands; Bakker, D., Hague Consulting Group, Netherlands; Cohn, N., Hague Consulting Group, Netherlands; Kroes, E., Hague Consulting Group, Netherlands; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 100-120; In English; Copyright; Avail: Issuing Activity

This paper addresses recent model development by the Directorate General of Civil Aviation (DGCA) and Hague Consulting Group (HCG) concerning long-distance travel, Long-distance travel demand is growing very quickly and raising a great deal of economic and policy issues. There is increasing competition among the main Western European airports, and smaller, regional airports are fighting for market share. New modes of transport, such as high speed rail, arc also coming into the picture and affect the mode split for medium distance transport within Europe. Developments such as these are demanding the attention of policy makers and a tool is required for their analysis. For DGCA, Hague Consulting Group has developed a model system to provide answers to the policy questions posed by these expected trends, and to identify areas where policy makers can influence the traveller choices. The development of this model system, the Integrated Airport Competition Model/Integral Luchthaven Competitive Model (ILCM), began in 1992. Since that time the sub-models, input data and user interface have been expanded, updated and improved. HCG and DGCA have transformed the ILCM from a prototype into an operational forecasting tool.
Author
Airports; Competition; Models; Forecasting; Economics

20000046630 University of Southern Illinois, Carbondale, IL USA
Planning for New Primary Airports in the USA: A Survey of Metropolitan Planning Organizations
NewMyer, David A., University of Southern Illinois, USA; Journal of Air Transportation World Wide; 1999; ISSN 1093-8826; Volume 4, No. 2, pp. 49-64; In English; Copyright; Avail: Issuing Activity

Airport congestion at primary airports in major metropolitan areas was analyzed in a report prepared by the Transportation Research Board (TRB) in 1990. Taking the top twenty-three most congested airports from this study, a questionnaire was prepared and sent to the metropolitan planning organizations (MPOs) for twenty of the twenty-three metropolitan areas represented in the TRB study, The questionnaire focused on the role of the MPOs in planning for new primary airports in the USA, including

questions about the status of the most recent MPO airport system plan, whether or not the latest plan recommends a new primary airport, and whether or not any other entities in the MPO areas are recommending new primary airports. The results indicated that 44.4 percent of the eighteen respondent MPOs have airport system plans that are five years old or older. Also, only two of the respondent MPOs have recommended a new primary airport in their latest regional airport system plan and only one of these two is a common recommendation in the Federal Aviation Administration's National Plan of Integrated Airport System.
Author
Management; Planning; Airports; Surveys

20000048411 NASA Marshall Space Flight Center, Huntsville, AL USA
Marshall Space Flight Center High Speed Turbopump Bearing Test Rig
Gibson, Howard, NASA Marshall Space Flight Center, USA; Moore, Chip, NASA Marshall Space Flight Center, USA; Thom, Robert, NASA Marshall Space Flight Center, USA; 34th Aerospace Mechanisms Symposium; May 2000, pp. 331-342; In English; See also 20000048380; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Marshall Space Flight Center has a unique test rig that is used to test and develop rolling element bearings used in high-speed cryogenic turbopumps. The tester is unique in that it uses liquid hydrogen as the coolant for the bearings. This test rig can simulate speeds and loads experienced in the Space Shuttle Main Engine turbopumps. With internal modifications, the tester can be used for evaluating fluid film, hydrostatic, and foil bearing designs. At the present time, the test rig is configured to run two ball bearings or a ball and roller bearing, both with a hydrostatic bearing. The rig is being used to evaluate the lifetimes of hybrid bearings with silicon nitride rolling elements and steel races.
Author
High Speed; Turbine Pumps; Ball Bearings; Roller Bearings; Inspection

20000051541 Instituto Nacional de Tecnica Aeroespacial, Huelva, Spain
EQUIPMENT AND PROCEDURES FOR TEST RANGE OPERATION IN MISSILE EVALUATION
Blanco, Juan M., Instituto Nacional de Tecnica Aeroespacial, Spain; Mulero, Manuel, Instituto Nacional de Tecnica Aeroespacial, Spain; Small Rocket Motors and Gas Generators for Land, Sea and Air Launched Weapon Systems; April 2000, pp. 4-1 - 4-10; In English; See also 20000051537; Copyright Waived; Avail: CASI; A02, Hardcopy

Today's technology provides design engineers with sophisticated hardware and software tools that will help them to develop weapon systems from concept and feasibility early phases to prototype design and testing phases without almost having the need to see the "ultimate truth" of a real firing. Even for end-users. simulators systems help them in the severe requirement of being trained and ready to "play" on a daily basis. At the very end both designers and armed forces, will have to test under real firing, the performance of the weapon system and the capability to operate it in a near-to-real scenario. This is where Test Ranges get into play. This paper will introduce us in several aspects of the implementation of customer test requirements through the different phases that the test will go through. While prototype testing and tactical exercises seems to be of a complete different nature in their objectives, most of the Test Range activities, equipment, and procedures will be valid for both types of users. The approach selected for this paper is not only a purely "cold" description of equipment specifications but to show also some of the decision-making processes on which the customer and the Test Range has to agree to suit test requirements to Test Range capabilities. Cost analysis, although obviously relevant is not part of this study, while cost-effectiveness is.
Derived from text
Computer Programs; Computers; Equipment Specifications; Missile Ranges; Ballistic Ranges; Missiles

20000052127 Orincon Corp., La Jolla, CA USA
Airfield Ground Safety *Final Report, Oct. 1997 - Nov. 1999*
Petrescu, Jon; Mar. 2000; 44p; In English
Contract(s)/Grant(s): F30602-97-C-0353; AF Proj. 4748
Report No.(s): AD-A375863; OC-98-4311-U-0300; AFRL-IF-RS-TR-2000-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document is the final report for the Airfield Ground Safety (AGS) program under Air Force Research Laboratory-Rome contract number F30602-97-C-0333. The system developed under AGS, called the Ground Safety Tracking and Reporting System, uses multisensor data fusion from in-pavement inductive loop sensors to address a critical problem affecting out nation's airports: runway incursions. GSTARS is an effective, low-cost solution that provides aircraft and ground vehicle detection, classification (including aircraft type), and origin/destination tracking in all weather and visibility conditions. The system is currently installed at MacDill Air Force Base and provides increased situation awareness and tracking of ground traffic to air

traffic controllers in the Tower, and to base Operations and Base Command. GSTARS is based on inductive loop technology coupled with advanced signal processing and predictive networking techniques that provide airport surface traffic surveillance.
DTIC
Safety; Tracking (Position); Airports

20000053017 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
The ACETEF HLA Interface
O'Day, Stephen C.; McMaster, John W.; Sep. 1999; 6p; In English; Prepared in collaboration with J. F. Taylor Inc., Lexington Park, MD
Report No.(s): AD-A375781; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Air Combat Environment Test and Evaluation Facility (ACETEF) at Patuxent River Naval Air Station received a certificate of High Level Architecture (HLA) compliance in September 1999. The software vehicle for attaining compliance for the ACETEF simulation objective model (SOM) was the ACETEF FHL SWEG/JIMM interface. This interface is written in a flexible architecture which permits straightforward federation object model (FOM) extensions to the SOM object classes and the addition of FOM specific methods to the SOM base classes. The FOM specific extensions can be archived apart from the interface and re-used as needed. This interface is currently being used in the Joint Test and Training Capability Assessment (JTTCA) and the Joint Strike Fighter (JSF) Virtual Strike Warfare Environment 7 (VSWE7) exercises. A description of the software architecture and the philosophy behind the architecture is described. Methodologies for FOM specific code development are discussed.
DTIC
Software Engineering; Distributed Interactive Simulation; Computerized Simulation

20000053498 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
An AI Approach to Ground Station Autonomy for Deep Space Communications
Fisher, Forest, Jet Propulsion Lab., California Inst. of Tech., USA; Estlin, Tara, Jet Propulsion Lab., California Inst. of Tech., USA; Mutz, Darren, Jet Propulsion Lab., California Inst. of Tech., USA; Paal, Leslie, Jet Propulsion Lab., California Inst. of Tech., USA; Law, Emily, Jet Propulsion Lab., California Inst. of Tech., USA; Stockett, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Golshan, Nasser, Jet Propulsion Lab., California Inst. of Tech., USA; Chien, Steve, Jet Propulsion Lab., California Inst. of Tech., USA; Nov. 06, 1998; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes an architecture for an autonomous deep space tracking station (DS-T). The architecture targets fully automated routine operations encompassing scheduling and resource allocation, antenna and receiver predict generation. track procedure generation from service requests, and closed loop control and error recovery for the station subsystems. This architecture has been validated by the construction of a prototype DS-T station, which has performed a series of demonstrations of autonomous ground station control for downlink services with NASA's Mars Global Surveyor (MGS).
Derived from text
Ground Stations; Autonomy; Automatic Control

20000054782 Royal Aeronautical Society, London, UK
Flight Simulation - The Next Decade: Proceedings
[2000]; 246p; In English; Flight Simulation - The Next Decade, 10-12 May 2000, London, UK; See also 20000054783 through 20000054806; ISBN 1-85768-191-6; Copyright; Avail: Issuing Activity

Contents include the following: Keeping simulators in pace with a fourth generation fighter aircraft. Interactive hybrid environment training. Applications and future trends in synthetic environments for military training systems. Improving operational effectiveness: A vision for aircrew mission training. Flight crew training needs for future. The importance of matching technology advancement with training needs. Predictive models for aerial re-fueling simulations. PC flight simulators: Don't call them games anymore. Future visual system technologies. and Collective training-virtually a reality or still over the horizon.
CASI
Conferences; Fighter Aircraft; Flight Crews; Flight Training

20000054783 Saab Aircraft Co., Linkoeping, Sweden
Keeping Simulators in Pace with a Fourth Generation Fighter Aircraft
Sandberg, Stefan, Saab Aircraft Co., Sweden; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 2.1 - 2.4; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The challenge to keep a flight-training simulator in pace with the technological advances in the aircraft has proven to be a time and resource consuming exercise and has not always been met with success. It is a known fact to the flight simulator

community that flight simulators lagging behind the aircraft standard are more common than one would expect knowing that the trainers provide a safer and more cost efficient way of training pilots. Experience shows that the available budget for a weapon system upgrade is spent on the weapon system itself rather that on its training system. The absolute requirement from the end user of the aircraft system is that the flight simulators should be modified, validated and commissioned in time to meet the training requirement. This normally means that the simulators should be available for training at the same time or earlier than the arrival of the modified aircraft. A desirable requirement would be to have the simulator to support the flight test, evaluation and the development of new training programs and tactics that are performed by the contractor and the customer prior to the introduction to the operational squadron. In the Swedish Air Force Saab Viggen program this objective has successfully been met through the adaptation of the development process to support the flight training simulator.
Author
Education; Flight Simulators; Flight Tests; Flight Training; Physical Exercise; Training Devices; Training Simulators

20000054785 CAE Electronics Ltd., Saint Laurent, Quebec Canada
Applications and Future Trends in Synthetic Environments for Military Training Systems
Howells, P. B., CAE Electronics Ltd., Canada; Siksik, D. N., CAE Electronics Ltd., Canada; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 4.1 - 4.8; In English; See also 20000054782; Copyright; Avail: Issuing Activity

This paper gives details of the new generation of simulators that have been built. These simulators use Synthetic Environments to increase training capability. In recent years, the trend has shifted markedly from the synthetic environment that merely provided a threat lay down to a synthetic environment that provides support for collaborative training. In this new role, the synthetic environment complements training through computer generated entities that maneuver and behave as manned counterparts. The example systems presented in this paper cover a broad spectrum of applications that encompasses air, land and sea domains.
Author
Education; Training Simulators; Training Evaluation

20000054786 British Aerospace Aircraft Group, Flight Training (Europe) S.L., Jerez de la Frontera, Spain
Ab-Initio Simulation in the 21st Century
Green, Steven, British Aerospace Aircraft Group, Spain; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 6.1 - 6.6; In English; See also 20000054782; Copyright; Avail: Issuing Activity

Despite the development in manned flight in the 20th century, flight simulation is still in its infancy. This paper reviews the future simulator contribution to ab-initio airline pilot training. It will ask if zero flight time training will be a practical proposition in the next century and examine areas which can be successfully exploited by low-cost high-fidelity training devices. It will also address the impact of new technologies such as virtual reality and helmet-mounted displays. Given the correct learning and operating environment, it is the view of the author that zero flight time ab-initio training will be possible. It probably is today, but practicalities preclude it. Simulation increases the objectivity of both flight training and assessment. Helmet-mounted technology and virtual reality will reduce dependence on complex electromechanical devices. Such training will require Airline and Regulator to co-operate actively and contribute, whilst Flight Training Organisations (FTOs) will develop innovative solutions to evaluate trainees' capacity, decision-making processes and hand/eye coordination. Currently, the cost-effective utilisation of an FFS (Full Flight Simulator) is beyond most FTOs, but innovation with PC Technology will provide solutions. For example, a partnership between an FTO and a company specializing in low-cost PC-based simulation to meet Joint Aviation Authorities (JAA)requirements will be discussed. The paper will also look at trials of helmetmounted displays and their application to flight training, the value of motion versus visual, and the need for programmable machines rather than type-specific FFS. Finally, real-time ATC/traffic environment will be interfaced with the training device. Training must be more effective, safer and cheaper than current practice. A challenge in a conservative industry working on the traditional basis that a good scare is worth more to man than advice. However, there will be enthusiasm from industry for a better and cheaper product, which understands that "experience is not what happens to a man, but what a man does with what happens to him". Pilots can be trained as crew-people; the piston/jet interface removed and Crew Resource Management (CRM) and Company Operating Philosophies introduced from the beginning. Much of the instruction will actually be delivered by Computer Based Training. Safety will be enhanced in training because there will be no physical risk from technical or human malfunction, the trainee passing directly into a supervised multi-crew environment. Training effectiveness, cost-effectiveness and learning transfer effectiveness will be enhanced. Controlled evaluation will take place in a partnership of FTOs, Regulators and Industry. Ab-initio flight training in simulated devices will focus on providing experience about making decisions. It is this new approach which will really contribute to flight safety in the next century.
Author
Airline Operations; Display Devices; Education; Flight Simulation; Flight Simulators; Flight Training; Helmet Mounted Displays; Resources Management; Training Devices

20000054788 Boeing Co., Mesa, AZ USA

The Instructor/Operator Station: Where Do We Go From Here?

Faconti, Victor, Boeing Co., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 11.1 - 11.9; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The instructor/operator station (IOS) has undergone a number of evolutionary changes since the use of flight simulators for pilot training became commonplace. This evolution has been driven both by the increasing role of the training simulator in providing an adjunct to the real-world system as a training tool and the major advances in enabling technologies. In 1979 I presented a paper to the RAeS conference on "Fifty Years of Flight Simulation" and in that, I outlined the development of instructor stations from the rudimentary "crabs" crawling on paper maps to the most modern CRT-based system, at that time, used on the B-52 Weapon System Trainer (WST). Since then advances in technology have given us better pictures on CRTs (and now LCDs) and several orders of magnitude increase in capabilities and features. In the meantime, flight training philosophy has itself undergone a revolution in the approach to training methodology. Most major military planners now think in terms of team training as opposed to individual or even crew training. The civil aviation industry is looking at the benefit of "real-world" training where other elements in the scenario are other operators also training in the same problem. It is clear that team training will be the standard in both military and civilian flight simulator training as we move into the 21st century.

Author

Training Simulators; Training Devices; Pilot Training; Flight Training; Flight Simulators; Man Machine Systems

20000054789 CAE Aircrew Training Services Public Ltd. Co., Wallingford, UK

MSHATF: Delivering Military Helicopter Training in the New Millennium

Symes, Brian, CAE Aircrew Training Services Public Ltd. Co., UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 12.1 - 12.4; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The UK Ministry of Defence (MoD)'s decision, in October 1997, to award a 40 year Private Finance Initiative contract to CAE Aircrew Training Services plc for the design, construction, management , financing and operation of a purpose-built facility to provide simulator training for RAF Support Helicopter aircrews, marked a new concept for training delivery to the Royal Air Force. This paper will summarize the rationale and training objectives which underpinned the decision to adopt the Medium Support Helicopter Training Facility (MSHATF) approach. It will provide a flavour of the demanding functional requirements specified for the training facility by the MoD and detail the various elements of the training service, including the 6 Dynamic Mission Simulators and the Tactical Control Centre - which makes the MSHATF unique. It will review progress to date in delivering the contracted training service, consider the potential of the MSHATF and speculate on the extent to which this might be exploited in the future.

Author

Military Helicopters; Training Simulators; Construction; Functional Design Specifications

20000054792 Joint Aviation Authorities, Hoofddorp, Netherlands

The Role of the Regulator

Otto, Dietrich, Joint Aviation Authorities, Netherlands; Irving, Don, Civil Aviation Authority, UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 15.1 - 15.7; In English; See also 20000054782; Copyright; Avail: Issuing Activity

Where is training on Synthetic Training Devices (STD) heading? Is such training limitless or should the regulator define the limits of STD training acceptability/development. Talking about the regulator this will be the European angle of view, so the Joint Aviation Authorities (JAA) will be the focus. The regulator and all other parties involved are confronted with a vast amount of expectations and resulting commitments, all having a potential influence on rule making. The challenges of higher mobility of people, technical complexity of equipment and increasingly limited financial and personnel resources will have to be addressed,shortcomings identified and subsequently managed. The goal of mutual recognition of Flight a Simulator evaluations within the JAA has been clearly defined - and considerable progress made. Nevertheless there is much ground still to be covered. Mutual recognition has to extend beyond the JAA membership the ideal goal is global harmonization and mutual recognition. FAA/JAA harmonization efforts represent a significant start in this essential process. The European Union's declaration of competency in the matter of aviation regulation throughout the EU membership will provide a stiff test for the JAA in the content and structure of future Joint Aviation Requirements (JARs), including those for STDs. The establishment of, and transition to, a European Aviation Safety Authority (EASA) will undoubtedly impact on the JAA and care must be taken to ensure that the transition is smooth and that earlier mistakes are not repeated, The European regulator would do well to ensure that future rulemaking follows existing established and well-defined principles to prevent a divergence of the requirements for the EU and non-EU members of the JAA. Already different Authorities around the world make use of European (JAA) or North American

(FAA) civil aviation regulations. Thus if these two standards can be effectively harmonized they could form the basis of a world-wide standard in aviation regulation.
Author
Civil Aviation; Education; Flight Safety; Flight Simulators; Personnel; Regulations; Regulators; Training Devices

20000054793 Federal Aviation Administration, National Simulator Program, Atlanta, GA USA
Is Today's Flight Simulator Prepared For Tomorrow's Requirements?
Ray, Paul A., Federal Aviation Administration, USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 16.1 - 16.8; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The role of flight simulation in today and tomorrow's training environment clearly tests the capability of yesterday's flight simulators. The aviation industry (manufacturer, user, and regulator) clearly desires an increasing reliance upon flight simulation for total training and testing. Due, in large part, to the success of yesterday's flight simulators, it is highly likely that flight simulators will become the mandated vehicle for training and testing, not simply a cost effective alternative for those able to afford its benefits. As training centers and airlines address the potential use of flight simulators for limited unusual attitude training, prevention of controlled flight into terrain and training in areas unsafe to perform in actual flight, regulatory authorities are, in all likelihood, going to increase flight simulator fidelity requirements. This paper addresses fidelity issues that, in some cases are clearly lacking in some of today's flight simulators and previously assumed to be accurately presented. Should those deficiencies be corrected? Should "grandfather rights" prevail? to what extent should existing flight simulators be "grandfathered"? These issues, as well as other fidelity issues are addressed. Recommendations are offered for correcting omissions and/or updating current flight simulation. Other recommendations, including a joint FAA and JAA resolution to update international sound, visual and motion standards are also discussed.
Author
Commercial Aircraft; Correction; Education; Flight Control; Flight Simulation; Flight Simulators; Regulators

20000054794 Flight Safety Boeing Training International, Canada
The Importance of Matching Technology Advancement With Training Needs
Caudrey, Kip, Flight Safety Boeing Training International, Canada; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 18.1 - 18.7; In English; See also 20000054782; Copyright; Avail: Issuing Activity

Introduction Advances made in Simulation Technology particularly during the past 10 years have been astonishing, primarily a result of the massive increases in host and image generator computing power. Who would have guessed that it would now be possible to run a FFS including Motion & Visual from a laptop? However, few would disagree that although the fidelity of simulation and consequently training realism has been significantly improved during the same period, it has not kept pace with Technology. During the next decade many challenges face our industry; change in emphasis from handling skills to Avionics management and Crew management is already evident and will inevitably continue. Many younger pilots specifically trained for airline operations will be recruited but not from the traditional sources and they will not have the experience that major carriers have been accustomed to. More Airlines will form alliances; they will demand standardization of training equipment as well as training curricula. More Airlines will switch to third party training. New airspace management and control will necessitate different training. AQP and similar programs will require new training methodology. FOQA (Flight Ops Quality Assurance) derived information will result in improved knowledge of training weaknesses and be fed back into training programs. Some Airlines may opt for fully integrated LOFT training with ATC as we see happening at DLH. Above all else distance learning and use of the Internet will result in the greatest change as to how training will be conducted. It is our responsibility to ensure that the power of new technology is driven by training requirements and implemented expeditiously.
Author
Airline Operations; Commercial Aircraft; Education; Quality Control; Standardization; Systems Simulation

20000054796 Boeing Commercial Airplane Co., Seattle, WA USA
Improving the Value of Commercial Training Simulators: Key Concerns and the Search for Resolution
Curnutt, Robert A., Boeing Commercial Airplane Co., USA; Neville, Kendall W., Boeing Commercial Airplane Co., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 20.1 - 20.8; In English; See also 20000054782; Copyright; Avail: Issuing Activity

New approaches for validation and utilization of flight crew training simulators for large commercial transport aircraft have been proposed or are in the process of being approved and/or implemented. For each of these concepts, the objective is to meet real training needs more efficiently while retaining or even improving the benefit of simulator training. Associated with these ideas are valid concerns that must be resolved before the new methodology can be implemented to the satisfaction of the training

community. This paper presents a survey of some key concerns, current activities, and several possible new approaches to improving training simulator value,
Author
Training Simulators; Transport Aircraft; Flight Training; Education; Proving

20000054798 Jane's Combat Simulations/Electronic Arts, Redwood City, CA USA
PC Flight Simulators: Don't Call Them Games Anymore
Pisanich, Greg, Jane's Combat Simulations/Electronic Arts, USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 22.1 - 22.3; In English; See also 20000054782; Copyright; Avail: Issuing Activity

This paper explores the effect of new technologies on the use of PC-based flight simulators for training and research environments.
Author
Flight Simulators; Technological Forecasting; Training Devices

20000054799 Federal Aviation Administration, Volpe Center, Cambridge, MA USA
Simulator Fidelity: The Effect of Platform Motion
Buerkl–Cohen, Judith, Federal Aviation Administration, USA; Boothe, Edward M., Boothe (Edward M.), USA; Soja, Nancy N., Soja (Nancy N.), USA; DiSario, Robert, Bryant Coll., USA; Go, Tiauw, Massachusetts Inst. of Tech., USA; Longridge, Thomas, Federal Aviation Administration, USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 23.1 - 23.7; In English; See also 20000054782; Copyright; Avail: Issuing Activity

This research is part of the Federal Aviation Administration's (FAA) initiative towards promoting affordable flight simulators for U.S. commuter airline training. This initiative becomes even more important as the FAA is considering regulatory action that will mandate the use of simulators for all air carrier flight-crew training and qualification. Consequently, sound scientific data on the relationship between certain simulator features such as platform motion and their effect on the transfer of pilot performance and behavior to and from the respective airplane become very Important. The present study examined the effect of platform motion (i.e., FAA qualified Level C six-degree-of-freedom synergistic motion) in the presence of a high-quality wide-angle visual system on: 1) pilot performance and behavior for evaluation prior to any repeated practice or training, 2) the course of training In the simulator, and 3) the transfer of skills acquired during training in the simulator with or without motion to the simulator with motion as a stand-in for the airplane (quasi-transfer design). Every effort was made to avoid deficiencies in the research design identified in a review of prior studies, by measuring pilot stimulation and response, testing both maneuvers and pilots that are diagnostic of a need of motion, avoiding pilot and instructor bias, and ensuring sufficient statistical power to capture operationally relevant effects. Results of the analyses and their implications are presented in this paper.
Author
Research; Flight Simulators; Motion Simulators; Management; Education; Capture Effect; Air Transportation

20000054800 Aircraft Development and Systems Engineering, Hoofddorf, Netherlands
Integrated Motion Cueing Algorithm and Motion-Based Design for Flight Simulation
Advani, Sunjoo, Aircraft Development and Systems Engineering, Netherlands; Hosman, Ruud, Aerospace Man-Machine Systems Consulting, Netherlands; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 24.1 - 24.9; In English; See also 20000054782; Copyright; Avail: Issuing Activity

A strategy for the design of motion cueing in flight simulation is described in this paper. The proposed method aims at addressing the changing needs of pilot training, particularly with regard to the acquisition of basic flying skills. The strategy demonstrates how the knowledge in the area of pilot perception and control of aircraft motions and, secondly, the kinematic design of flight simulator motion-bases can be integrated so as to yield a family of training devices optimized for a given training requirement. Through this approach, the simulator is "pre-adjusted" to the needs of the expected training needs by making design decisions early in the design specification phase. As a result, the cues presented to the pilot, as well as the capability of the simulator mechanism to generate those cues, are optimized simultaneously/concurrently. Flight simulators could thereby profit from a more effective and efficient use of the motion cueing system.
Author
Design Analysis; Flight Simulators; Training Devices; Pilot Training; Aircraft Control; Algorithms

20000054801 SEOS Displays Ltd., Burgess Hill, UK
The "All Digital Display"
Berwick, Paul, SEOS Displays Ltd., UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 25.1 - 25.8; In English;

See also 20000054782; Copyright; Avail: Issuing Activity

As the performance/price ratio of today's modern image generators becomes greater, so do the end users' display requirements. The ability to produce high-resolution imagery, rendering at vast pixel speeds, demands a display system capable of delivering the required high performance. Historically the solution has been to take an approach whereby the transmission chain was primarily set in the analogue domain. This gave rise to shortcomings inherent to this technology. This paper gives an overview of these typical systems and illustrates the shortcomings. From this, the paper develops a goal All Digital, from 'creation to consumption'. by moving into the digital domain, many of the traditional problems are removed, and some extra positive benefits obtained, e.g. reliability and maintainability. The image generator calculates and renders its image digitally. This is then transmitted to the projection device via a high-speed digital link. If the projection device is being used off axis then distortion correction is required. This can be applied using an innovative digital distortion corrector. (This correction imposes very small system latency and gives immense control over image quality). This distortion corrected image is then read digitally into the projection device for viewing. The above scenario is applicable to fixed matrix projection devices; LCD, DLP or even laser projectors. This paper examines how the digital domain is rapidly becoming a major simulation display solution.

Author

Display Devices; Analogs; Image Resolution; Simulation; Viewing; Digital Simulation

20000054802 CAE Electronics Ltd., Montreal, Quebec Canada

Future Visual System Technologies

Fernie, Andrew, CAE Electronics Ltd., Canada; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 26.1 - 26.6; In English; See also 20000054782; Copyright; Avail: Issuing Activity

Image generators (IG), video displays, and wide field-of-view (FOV) optical systems are rapidly improving in performance and capabilities. IGs are providing increased polygon and pixel counts, improved texture processing, and increased support for industry standards in smaller and easier to maintain packages. New projector technologies are brighter, higher contrast, less subject to drift, and support higher pixel counts. Simulator optical systems are configured with larger and larger FOVs. These changes provide the promise of greatly improved simulator visual systems in the coming years. Further, the rapid improvement in commercial-of-the-shelf (COTS) graphics hardware and projectors will allow simulator visual systems to take advantage of the resources being applied to the much larger commercial markets. While all of the features listed above are true, and can be objectively demonstrated, it is important to realise the context in which they are made in order to understand the inherent trade-offs. Acceptance of the benefits of all of these features without considering the unstated limitations may well result in a visual system that does not meet training expectations. It is also important to consider the forces for change. If a new feature becomes available which improves performance in one area, but degrades it elsewhere, there will be a certain reluctance to incorporate the new feature as there is risk that the final system may be determined to be unacceptable. If, however, there are other forces at work such as additional training credit from the ability to perform extra tasks in the simulator, then the shortcomings of the new features may be considered to be acceptable. This paper explores the technological advances that have the potential of advancing the state of simulator visual systems, while considering the trade-offs that may result from incorporation of these features. It also explores the forces for change, and the context in which the acceptability of the change is determined.

Author

Technology Assessment; Acceptability; Display Devices; Field of View; Simulators; Market Research

20000054803 CAE Electronics Ltd., Saint Laurent, Quebec Canada

Systems and Research in Networked Tactical Training

Kruk, R. V., CAE Electronics Ltd., Canada; Wightman, D. C., Army Research Inst., USA; Howse, W. R., Army Research Inst., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 28.1 - 28.12; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The Rotary-wing Advanced Networked Training System (RANTS) is the focus of a Cooperative Research and Development Agreement between the U.S. Army Research Institute (ARI) and CAE Electronics to develop low-cost, networked training technologies for tactical training and mission rehearsal. The project will be used to develop and evaluate training approaches, methodologies for performance assessment in networked training systems, and will also permit evaluation of a broad variety of low cost technologies for collective training. Changes in military aircraft, equipment, missions and training requirements have created a need to develop new training techniques as well as technologies to ensure tactical proficiency among aviators. A dramatically increased emphasis has been placed on collective training of intact units as opposed to individuals or crews in isolation, Appreciation of the resource requirements and effectiveness of synthetic collective training remains nascent in part because of the limited availability of properly equipped research venues. As well, realization of the full potential of these training approaches will likely demand development of novel instructional strategies. Among these is the use of collective synthetic

training as a predecessor to training in live environments. A study that explored the combination of synthetic and live environments for collective training is summarized herein. A U.S. Army Attack Helicopter Company, given one week of collective task training in a synthetic simulation, improved its rate of completion of collective tasks to 70 percent. This unit and a comparison Company were evaluated in a Field Training Exercise two weeks later. The comparison Company scored 65 percent collective task completion while the experimental Company scored an overall 98 percent. In common with most studies of this type, data collection and analysis aspects of the study were labor intensive. More sophisticated and less costly performance assessment methods must be developed if effective use of networked synthetic environment technology is to become commonplace. The RANTS project will support effective application of synthetic environments in collective training through research into training and assessment as well as technology.
Author
Data Acquisition; Education; Equipment Specifications; Helicopters; Rotary Wings; Simulation; Training Devices; Technology Assessment; Performance Tests

20000054804 Boeing Commercial Airplane Co., Simulation Engineering, Seattle, WA USA
Distributed Simulation Using COTS Software and Commodity Hardware
Jenkins, Andrew, Boeing Commercial Airplane Co., USA; Lambert, Frederic, Boeing Commercial Airplane Co., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 29.1 - 29.11; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The Desktop Simulator (DTS) is an integrated toolset used for visualization of complete airplane simulations in an engineering environment. This paper explores the design and implementation of the DTS, its current and future applications, and the role of commercial, off-the-shelf (COTS) software and commodity hardware in application domains traditionally ruled by high-end workstations and custom-built software.
Author
Computer Programs; Simulators; Display Devices

20000054805 Air Force Research Lab., Human Effectiveness Directorate, Mesa, AZ USA
Network Enabled Image Generators in a DIS and HLA Environment
Call, Lance R., Air Force Research Lab., USA; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 30.1 - 30.6; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The change from stand alone hosts to distributed simulations connected over a public network has changed the way image generators (IGs) and hosts relate. With most of the information about the virtual world existing on some type of public, Distributed Interactive Simulation (DIS) or High Level Architecture (HLA) network, it makes sense for IGs to become network enabled and access that information directly. A Visual Interface Unit (VIU) may be used to implement the host/ IG/network connection in a way that makes the IG interface independent of the host. This concept may be used with today's proprietary IG interfaces or with a proposed standard IG interface for a network enabled IG. With a network enabled IG the chance to create a common standard image generator interface becomes much more practical. The use of a standard IG protocol with a network-enabled IG makes the possibility of a "plug-and-play" IG much closer to reality than it is today., This would provide a much easier and less costly approach to upgrading simulators to take advantage of rapidly improving graphics technology.
Author
Distributed Interactive Simulation; Image Processing; Graphical User Interface; Function Generators

20000057417 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands
Outline and Application of GEROS: A European Grid Generator for Rotorcraft Simulation Methods
Hounjet, M. H. L.; Allen, C. B.; Vigevano, L.; Trivellato, N.; Pagano, A.; Jun. 1998; 36p; In English; ECCOMAS 1998, 7-11 Sep. 1998, Athens, Greece
Report No.(s): PB2000-104923; NLR-TP-98265; No Copyright; Avail: National Technical Information Service (NTIS)

GEROS is the name of a grid generator system for the modeling of complex multi-bladed rotors under development in Europe as a part of the development of a complete rotorcraft simulation method: The Brite/EuRam Eros project. The grid generator exploits a CHMERA domain decomposition on structured grids. The development is being carried out by rotorcraft manufacturers (Agusta, ECD, GKN-Westland), research centers (CIRA, DERA, DLR, ONERA), and Universities (Polit. Milano, Univ. Bristol, Univ. Glasgow, Univ. Rome 3). This paper discusses the capabilities of the GEROS grid generator and presents relevant results. NTIS
Structured Grids (Mathematics); Grid Generation (Mathematics); Computational Fluid Dynamics

20000057509 NASA Langley Research Center, Hampton, VA USA
Implementation of the WICS Wall Interference Correction System at the National Transonic Facility
Iyer, Venkit, NASA Langley Research Center, USA; Martin, Lockheed, NASA Langley Research Center, USA; Everhart, Joel L., NASA Langley Research Center, USA; Bir, Pamela J., Vigyan Research Associates, Inc., USA; Ulbrich, Norbert, Sverdrup Technology, Inc., USA; [2000]; 24p; In English; 21st; 21st Aerodynamic Measurement Technology and Ground Testing Conference, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS1-96014
Report No.(s): AIAA Pasper 2000-2383; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Wall Interference Correction System (WICS) is operational at the National Transonic Facility (NTF) of NASA Langley Research Center (NASA LaRC) for semispan and full span tests in the solid wall (slots covered) configuration, The method is based on the wall pressure signature method for computing corrections to the measured parameters. It is an adaptation of the WICS code operational at the 12 ft pressure wind tunnel (12ft PWT) of NASA Ames Research Center (NASA ARC). This paper discusses the details of implementation of WICS at the NTF including, tunnel calibration, code modifications for tunnel and support geometry, changes made for the NTF wall orifices layout, details of interfacing with the tunnel data processing system, and post-processing of results. Example results of applying WICS to a semispan test and a full span test are presented. Comparison with classical correction results and an analysis of uncertainty in the corrections are also given. As a special application of the code, the Mach number calibration data from a centerline pipe test was computed by WICS. Finally, future work for expanding the applicability of the code including online implementation is discussed.
Author
Aerodynamic Interference; Data Processing Equipment; Transonic Wind Tunnels; Wall Flow; Wall Pressure

10
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms.

20000054880 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Flying Cassini with Virtual Operations Teams
Dodd, Suzanne, Jet Propulsion Lab., California Inst. of Tech., USA; Gustavson, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Cassini Program's challenge is to fly a large, complex mission with a reduced operations budget. A consequence of the reduced budget is elimination of the large, centrally located group traditionally used for uplink operations. Instead, responsibility for completing parts of the uplink function is distributed throughout the Program. A critical strategy employed to handle this challenge is the use of Virtual Uplink Operations Teams. A Virtual Team is comprised of a group of people with the necessary mix of engineering and science expertise who come together for the purpose of building a specific uplink product. These people are drawn from throughout the Cassini Program and participate across a large geographical area (from Germany to the West coast of the USA), covering ten time zones. The participants will often split their time between participating in the Virtual Team and accomplishing their core responsibilities, requiring significant planning and time management. When the particular uplink product task is complete, the Virtual Team disbands and the members turn back to their home organization element for future work assignments. This time-sharing of employees is used on Cassini to build mission planning products, via the Mission Planning Virtual Team, and sequencing products and monitoring of the sequence execution, via the Sequence Virtual Team. This challenging, multitasking approach allows efficient use of personnel in a resource constrained environment.
Author
Cassini Mission; Saturn (Planet); Mission Planning; Virtual Reality; Flight Simulation

20000057175 RAND Corp., Santa Monica, CA USA
An Executive Guide to Space: A Starting Point for Understanding Space in the New Millennium
Carey, Steven D.; Jan. 1999; 78p; In English
Report No.(s): AD-A376661; RAND/P-8041-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Understanding space and how America plans to use it in the new millennium has captured the attention of our national leadership. Each branch of service within the military has discovered the tremendous warfighting potential of space. Such realization has fired intense doctrinal debates as well as fiscal competition for dwindling resources under the umbrella of this new

frontier. These emerging debates and the bottom-line budget battles have brought an entirely new dimension to our national priorities, which until now have been based on three mediums of warfare: land, sea, and air. Space brings us into the fourth dimension of warfare. As we move our warfighting into this new medium, it is imperative that we develop a fundamental appreciation and understanding of the nuts and bolts' of our current space debate.
DTIC
Aerospace Environments; Warfare; Aeronautical Engineering

20000057167 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Evaluation and Simulation of Range Extension of the Multiple Launch Rocket System *Final Report*
Haverdings, W. B., Prins Maurits Lab. TNO, Netherlands; Gadiot, G. M. H. J. L., Prins Maurits Lab. TNO, Netherlands; April 2000; 89p; In English; Original contains color illustrations
Contract(s)/Grant(s): A95/KL/410; TNO Proj. 014.10643
Report No.(s): TD-2000-008; PML-2000-A6; Copyright; Avail: Issuing Activity

This report describes the results of simulations carried out with a rocket trajectory code written in Matlab/Simulink. Matlab/Simulink is one of the modem tools for systems simulation and control systems design and analysis. With the computer code, the normal ballistic flight of the M270 rocket of a Multiple Launch Rocket System (MLRS) can be simulated. Also the flight characteristics of an improved rocket with aerodynamic control was implemented in the code. The results of typical flight trajectories of the two missiles were analysed and revealed a considerable extension of the range of the rocket, while the aerodynamic control system is relatively easy to implement in the rocket structure; requiring little space and having only minor influence on the total payload that the rocket is carrying.
Author
Systems Simulation; Launching; Range; Control Systems Design; Flight Characteristics; Rockets

20000057515 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-101: Atlantis Orbiter Upgrade Briefing
Mar. 27, 2000; In English; Videotape: 54 min. 45 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000076142; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows panelists, Manager of the Space Shuttle Program Development, Elric McHenry, and the Associate Program Manager for Space Shuttle Upgrades, Andy Allen, giving an overview of the new upgrades on the STS-101 Orbiter. McHenry and Allen speaks about the changes and modernization of Atlantis. The panelists' mentions all the new capabilities of the new glass cockpit. They emphasize the redesign of the engine, specifically, the ability to shut down automatically. They also discuss future implementation of a smart cockpit.
CASI
Revisions; Upgrading; Improvement; Cockpits; Pilot Support Systems; Engine Design

20000057033 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Autonomous Landing and Smart Anchoring for In-Situ Exploration of Small Bodies
Ghavimi, Ali R., Jet Propulsion Lab., California Inst. of Tech., USA; Serricchio, Frederick, Jet Propulsion Lab., California Inst. of Tech., USA; Hadaegh, Fred Y., Jet Propulsion Lab., California Inst. of Tech., USA; Dolgin, Ben, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Future NASA missions include in-situ scientific explorations of small interplanetary objects like comets and asteroids. Sample acquisition systems are envisioned to operate directly from the landers that are anchored to the surface. Landing and anchoring proves to be challenging in the absence of an attitude control system and in the presence of nearly zero-gravity environments with uncertain surface terrain and unknown mechanical properties. This paper presents recent advancements in developing a novel landing and anchoring control system for the exploration of small bodies.
Author
Autonomy; Landing Aids; Anchors (Fasteners); Space Exploration; Celestial Bodies; Control Systems Design

20000057460 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Light-Weight Inflatable Hypersonic Drag Device for Planetary Entry
McRonald, Angus D., Jet Propulsion Lab., California Inst. of Tech., USA; [1995]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The author has analyzed the use of a light-weight inflatable hypersonic drag device, called a ballute, (balloon + parachute) for flight in planetary atmospheres, for entry, aerocapture, and aerobraking. Studies to date include missions to Mars, Venus, Earth,

Saturn, Titan, Neptune and Pluto. Data on a Pluto lander and a Mars orbiter will be presented to illustrate the concept. The main advantage of using a ballute is that aero deceleration and heating in atmospheric entry occurs at much smaller atmospheric density with a ballute than without it. For example, if a ballute has a diameter 10 times as large as the spacecraft, for unchanged total mass, entry speed and entry angle,the atmospheric density at peak convective heating is reduced by a factor of 100, reducing the peak heating by a factor of 10 for the spacecraft, and a factor of about 30 for the ballute. Consequently the entry payload (lander, orbiter, etc) is subject to much less heating, requires a much reduced thermal protection system (possibly only an MLI blanket), and the spacecraft design is therefore relatively unchanged from its vacuum counterpart. The heat flux on the ballute is small enough to be radiated at temperatures below 800 K or so. Also, the heating may be reduced further because the ballute enters at a more shallow angle, even allowing for the increased delivery angle error. Added advantages are a smaller mass ratio of entry system to total entry mass, and freedom from the low-density and transonic instability problems that conventional rigid entry bodies suffer, since the vehicle attitude is determined by the ballute, usually released at continuum conditions (hypersonic for an orbiter, and subsonic for a lander). Also, for a lander the range from entry to touchdown is less, offering a smaller footprint. The ballute derives an entry corridor for aerocapture by entering on a path that would lead to landing, and releasing the ballute adaptively, responding to measured deceleration, at a speed computed to achieve the desired orbiter exit conditions. For a lander an accurate landing point could be achieved by providing the lander with a small gliding capacity, using the large potential energy available from being subsonic at high altitude. Alternatively the ballute can be retained to act as a parachute or soft-landing device, or to float the payload as a buoyant aerobot. As expected, the ballute has smaller size for relatively small entry speeds, such as for Mars, or for the extensive atmosphere of a low-gravity planet such as Pluto. The author will discuss presently available ballute materials and a development program of aerodynamic tests and materials that would be required for ballutes to achieve their full potential. Author

Aerobraking; Atmospheric Entry; Ballutes; Drag Devices; Parachute Descent; Planetary Landing; Hypersonic Speed

20000057503 NASA Goddard Space Flight Center, Greenbelt, MD USA

Optimal Configurations for Rotating Spacecraft Formations

Hughes, Steven P., NASA Goddard Space Flight Center, USA; Hall, Christopher D., Virginia Technologies, Inc., USA; [2000]; 23p; In English; Richard H. Battin Astrodynamics Symposium, 20-21 Mar. 2000, College Station, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper a new class of formations that maintain a constant shape as viewed from the Earth is introduced. An algorithm is developed to place n spacecraft in a constant shape formation spaced equally in time using the classical orbital elements. to first order, the dimensions of the formation are shown to be simple functions of orbit eccentricity and inclination. The performance of the formation is investigated over a Keplerian orbit using a performance measure based on a weighted average of the angular separations between spacecraft in formation. Analytic approximations are developed that yield optimum configurations for different values of n. The analytic approximations are shown to be in excellent agreement with the exact solutions. Author

Orbital Elements; Algorithms; Spacecraft; Aircraft Configurations; Formations

20000054888 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Integrated Avionics System (IAS), Integrating 3-D Technology On A Spacecraft Panel

Hunter, Don J., Jet Propulsion Lab., California Inst. of Tech., USA; Halpert, Gerald, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 30p; In English; The Direct Menthanol Fuel Cell Prospects for Commercialization, 4-5 Feb. 1999, Washington, DC, USA; Sponsored by American Methanol Inst., USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As spacecraft designs converge toward miniaturization, and with the volumetric and mass challenges placed on avionics, programs will continue to advance the "state of the art" in spacecraft system development with new challenges to reduce power, mass and volume. Traditionally, the trend is to focus on high-density 3-D packaging technologies. Industry has made significant progress in 3-D technologies, and other related internal and external interconnection schemes. Although new technologies have improved packaging densities, a system packaging architecture is required that not only reduces spacecraft volume and mass budgets, but increase integration efficiencies, provide modularity and flexibility to accommodate multiple missions while maintaining a low recurring cost. With these challenges in mind, a novel system packaging approach incorporates solutions that provide broader environmental applications, more flexible system interconnectivity, scalability, and simplified assembly test and integration schemes. The Integrated Avionics System (IAS) provides for a low-mass, modular distributed or centralized packaging architecture which combines ridged-flex technologies, high-density COTS hardware and a new 3-D mechanical packaging

approach, Horizontal Mounted Cube (HMC). This paper will describe the fundamental elements of the IAS, HMC hardware design, system integration and environmental test results.
Author
Avionics; Systems Integration; Systems Engineering; Hardware; Spacecraft Design

20000056611 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Deep Space One High-Voltage Bus Management
Rachocki, Ken, Spectrum Astro, Inc., USA; Nieraeth, Donald, Jet Propulsion Lab., California Inst. of Tech., USA; Apr. 22, 1999; 12p; In English; Space Power Workshop, 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design of the High Voltage Power Converter Unit on DS1 allows both the spacecraft avionics and ion propulsion to operate in a stable manner near the PPP of the solar array. This approach relies on a fairly well-defined solar array model to determine the projected PPP. The solar array voltage set-points have to be updated every week to maintain operation near PPP. Stable operation even to the LEFT of the Peak Power Point is achievable so long as you do not change the operating power level of the ion engine. The next step for this technology is to investigate the use of onboard autonomy to determine the optimum SA voltage regulation set-point (i.e. near the PPP); this is for future missions that have one or more ion propulsion subsystems.
Derived from text
Avionics; High Voltages; Power Converters; Deep Space 1 Mission; Bus Conductors; Electric Potential

11
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft.

20000053532 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Finishing Systems for Naval Aircraft Applications: Current Schemes and Future Trends
Kovaleski, Kevin J.; Kane, Michael J.; Spadafora, Stephen J.; Pulley, David F.; Hirst, Donald J.; Jan. 2000; 36p; In English
Report No.(s): AD-A375910; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coating systems on Navy aircraft perform a variety of functions, but clearly the most critical of these is the protection of aircraft structures from environmental degradation. Protective coatings serve as the primary defense against corrosion of aircraft metallic alloys, as well as degradation of other materials such as polymeric composites. Traditional coatings for aircraft include inorganic pretreatments, epoxy primers, and polyurethane topcoats. Pretreatments provide some corrosion protection and prepare the surface for subsequent organic coatings. Primers normally Contain high concentrations of corrosion inhibitors, such as chromates, and are designed to provide superior adhesion and corrosion protection. Polyurethane topcoats are formulated to enhance protection and durability; they also provide desired optical effects including aesthetics and camouflage. More recently, alternative coatings have been developed, such as nonhexavalent chromate pretreatments and primers, self-priming topcoats, flexible primers, low volatile organic compounds (VOC) Content coatings, temporary and multifunctional coatings. These new developments reflect trends in protective coatings technology, changes in aircraft operational requirements/capabilities, and most dramatically, concerns over environmental protection and worker safety. These environmental issues have created a drive toward coatings protection and worker safety. These environmental issues have created a drive toward coatings with ultra low/zero concentrations of VOC and nontoxic corrosion inhibitors. In turn, these changes have led to concerns over long-term performance, especially protection against corrosion. This report reviews current protective coatings technology for Navy aircraft structures and discusses future needs and trends based on advancing technology, environmental concerns, and operational requirements.
DTIC
Corrosion Prevention; Aircraft Structures; Protective Coatings; Coating; Military Aircraft

20000057297 DYNACS Engineering Co., Inc., Cleveland, OH USA
Silicon-Based Ceramic-Matrix Composites for Advanced Turbine Engines: Some Degradation Issues
Thomas–Ogbuji, Linus U. J., DYNACS Engineering Co., Inc., USA; [2000]; 18p; In English; 5th; Advanced Materials for 21st Century Turbines and Power Plant, 3-7 Jul. 2000, Cambridge, UK
Contract(s)/Grant(s): NAS3-27186; RTOP 714-04-30; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

SiC/BN/SiC composites are designed to take advantage of the high specific strengths and moduli of non-oxide ceramics, and their excellent resistance to creep, chemical attack, and oxidation, while circumventing the brittleness inherent in ceramics. Hence,

these composites have the potential to take turbine engines of the future to higher operating temperatures than is achievable with metal alloys. However, these composites remain developmental and more work needs to be done to optimize processing techniques. This paper highlights the lingering issue of pest degradation in these materials and shows that it results from vestiges of processing steps and can thus be minimized or eliminated.
Author
Turbine Engines; Ceramic Matrix Composites; Silicon; Degradation; Creep Properties; Alloys

20000057165 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Experimental Investigation of Supersonic Combustion of Liquid Hydrocarbon Fuel Using Barbotage in the Aeroramp Configuration at M=2.5 *Final Report*
Sabelnikov, Vladimir; Aug. 10, 1999; 36p; In English
Contract(s)/Grant(s): F61775-98-WE118
Report No.(s): AD-A368781; EOARD-SPC-98-4078; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This report results from a contract tasking TsAGl as follows: The contractor will investigate combustion of kerosene using barbotage by hydrogen and air in the aeroramp configuration at M=2.5 as described in his proposal dated 1 Jun 98.
DTIC
Supersonic Combustion; Liquid Hydrogen; Fuel Combustion

20000047293 Kawasaki Heavy Industries Ltd., Gifu, Japan
Studies on Long Term Durability of Aluminum Airframe Structure made by Affordable Process
Hira, Hirohito, Kawasaki Heavy Industries Ltd., Japan; Yoshino, Yasuaki, Kawasaki Heavy Industries Ltd., Japan; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 11-1 - 11-7; In English; See also 20000047290; Copyright Waived; Avail: CASI; A02, Hardcopy
Affordability is one of the most important problems of today's development of airframe especially for aluminum alloy application. Some new aluminum alloys and improved processes are being applied to production cost reduction, and tests related to long term durability of applied structures are also carried out. In this report, our recent studies of following three affordable process methods to aluminum alloy structures are introduced, these are outline of process studies and their merits, and mechanical properties, fatigue properties and corrosion resistance. (1) Application of new 6000 series alloy of high formability; (2) Application of premium precision casting; and (3) Application of superplastic forming.
Author
Research; Durability; Airframes; Aluminum Alloys; Service Life; Mechanical Properties

20000047296 Institute for Aerospace Research, Structures, Materials and Propulsion Lab., Ottawa, Ontario Canada
RRA Heat Treatment of Large Al 7075-T6 Components
Holt, R. T., Institute for Aerospace Research, Canada; Raizenne, M. D., Institute for Aerospace Research, Canada; Wallace, W., Institute for Aerospace Research, Canada; DuQuesnay, D. L., Royal Military Coll. of Canada, Canada; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 7-1 - 7-11; In English; See also 20000047290; Copyright Waived; Avail: CASI; A03, Hardcopy
Retrogression and re-aging (RRA) is a heat treatment process performed on the aluminum alloy 7075 in the T6xxx temper condition to improve its resistance to corrosion, while at the same time maintaining the high strength levels required for aircraft structural applications. For large extruded or forged parts, we have determined that the most practical process involves retrogression at 195 C for 40 minutes, followed by rapid cooling and full re-aging at 120 C for 24 hours, After an RRA treatment of a large extrusion (a three-metre section from a CC-130 sloping longeron), we measured a shrinkage of approximately 0.01S%, with minimal distortion damage. There is a small loss of strength, e.g. the RRA yield strength is typically 5 15 MPa compared to 530 MPa for the same material in the T-6 condition. The corrosion resistance measured both by exfoliation and stress corrosion cracking are significantly better than for the T-6 condition and approach that for the over-aged T-73 condition. Furthermore, the fatigue resistance and fracture toughness of RRA treated material are both within the scatter bands for the T6 condition. For many thick section extrusions and forgings, rework specifications allow for the removal of up to 10% of the material thickness to remove service-exposed corrosion damage (after which the part must be replaced). Hence, the small penalty in strength experienced after the RRA treatment is more than compensated for by improved corrosion resistance, which can eliminate the need to remove corroded material.
Author
Heat Treatment; Aluminum Alloys; Corrosion Resistance; Yield Strength; Stress Corrosion Cracking; Aircraft Structures

20000055609 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Demonstration and Validation of Trivalent Aluminum Pretreatment on U.S. Navy S-3 Aircraft

Matzdorf, Craig; Kane, Michael; Green, James; May 18, 1999; 12p; In English

Report No.(s): AD-A375739; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Trivalent Chromium Pretreatment (TCP) demonstration and validation program is currently being executed for Naval Aviation platforms. The aft section of two S-3 aircraft has been treated using a spray-on process at the Naval Aviation Depot (NADEP) at North Island, California. The coating system on these aircraft will be evaluated for corrosion performance and paint adhesion at regular intervals. The S-3s will be in service during their evaluation period. Trivalent Chromium Pretreatment demonstration and validation efforts are also underway for aircraft stationed at NADEP Cherry Point, North Carolina and NADEP Jacksonville, Florida. A thorough demonstration and validation of TCP will ensure an efficient transition to the fleet. Other opportunities are being solicited for demonstration and validation TCP throughout the Department of Defense, the National Aeronautical and Space Administration, and original equipment manufacturers.

DTIC

Aluminum Coatings; S-3 Aircraft; Corrosion Prevention; Metal Coatings

20000057066 NASA Glenn Research Center, Cleveland, OH USA

Effects of Heat Treatment on the Ballistic Impact Properties of Inconel 718 for Jet Engine Fan Containment Applications

Pereira, J. Michael, NASA Glenn Research Center, USA; Lerch, Bradley A., NASA Glenn Research Center, USA; [2000]; 33p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of heat treating Inconel 718 on the ballistic impact response and failure mechanisms were studied. Two different annealing conditions and an aged condition were considered. Large differences in the static properties were found between the annealed and the aged material, with the annealed condition having lower strength and hardness and greater elongation than the aged. Correspondingly large differences were found in the velocity required to penetrate material in the two conditions in impact tests involving 12.5 mm diameter, 25.4 mm long cylindrical Ti-6-4 projectiles impacting flat plates at velocities in the range of 150 to 300 m/sec. The annealed material was able to absorb over 25 percent more energy than the aged. This is contrary to results observed for ballistic impact response for higher velocity impacts typically encountered in military applications where it has been shown that there exists a correlation between target hardness and ballistic impact strength. Metallographic examination of impacted plates showed strong indication of failure due to adiabatic shear. In both materials localized bands of large shear deformation were apparent, and microhardness measurements indicated an increase in hardness in these bands compared to the surrounding material. These bands were more localized in the aged material than in the annealed material. In addition the annealed material underwent significantly greater overall deformation before failure. The results indicate that high elongation and better strain hardening capabilities reduce the tendency for shear to localize and result in an unstable adiabatic shear failure. This supports empirical containment design methods that relate containment thickness to the static toughness.

Author

Heat Treatment; Impact Tests; Impact Resistance; Temperature Effects; Terminal Ballistics; Metallography; Jet Engines; Containment

20000057324 Boeing Co., Long Beach, CA USA

Validated Feasibility Study of Integrally Stiffened Metallic Fuselage Panels for Reducing Manufacturing Costs ***Final Report***

Pettit, R. G., Boeing Co., USA; Wang, J. J., Boeing Co., USA; Toh, C., Boeing Co., USA; May 2000; 63p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS1-20014; RTOP 522-12-51-01

Report No.(s): NASA/CR-2000-209342; NAS 1.26:209342; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The continual need to reduce airframe cost and the emergence of high speed machining and other manufacturing technologies has brought about a renewed interest in large-scale integral structures for aircraft applications. Applications have been inhibited, however, because of the need to demonstrate damage tolerance, and by cost and manufacturing risks associated with the size and complexity of the parts. The Integral Airframe Structures (IAS) Program identified a feasible integrally stiffened fuselage concept and evaluated performance and manufacturing cost compared to conventional designs. An integral skin/stiffener concept was produced both by plate hog-out and near-net extrusion. Alloys evaluated included 7050-T7451 plate, 7050-T74511 extrusion, 6013-T6511 extrusion, and 7475-T7351 plate. Mechanical properties, structural details, and joint performance were evaluated as well as repair, static compression, and two-bay crack residual strength panels. Crack turning behavior was characterized through panel tests and improved methods for predicting crack turning were developed. Manufacturing cost was evaluated using COSTRAN. A hybrid design, made from high-speed machined extruded frames that are mechanically fastened to high-speed

machined plate skin/stringer panels, was identified as the most cost-effective manufacturing solution. Recurring labor and material costs of the hybrid design are up to 61 percent less than the current technology baseline.
Author
Feasibility; Residual Strength; Fuselages; Cost Reduction; Aircraft Structures; Operating Costs; Mechanical Properties

20000057339 Boeing Commercial Airplane Co., Seattle, WA USA
Integral Airframe Structures (IAS): Validated Feasibility Study of Integrally Stiffened Metallic Fuselage Panels for Reducing Manufacturing Costs *Final Report*
Munroe, J., Boeing Commercial Airplane Co., USA; Wilkins, K., Boeing Commercial Airplane Co., USA; Gruber, M., Boeing Commercial Airplane Co., USA; May 2000; 347p; In English
Contract(s)/Grant(s): NAS1-20014; NAS1-20267; RTOP 522-12-51-01
Report No.(s): NASA/CR-2000-209337; NAS 1.26:209337; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Integral Airframe Structures (IAS) program investigated the feasibility of using "integrally stiffened" construction for commercial transport fuselage structure. The objective of the program was to demonstrate structural performance and weight equal to current "built-up" structure with lower manufacturing cost. Testing evaluated mechanical properties, structural details, joint performance, repair, static compression, and two-bay crack residual strength panels. Alloys evaluated included 7050-T7451 plate, 7050-T74511 extrusion, 6013-T6511x extrusion, and 7475-T7351 plate. Structural performance was evaluated with a large 7475-T7351 pressure test that included the arrest of a two-bay longitudinal crack, and a measure of residual strength for a two-bay crack centered on a broken frame. Analysis predictions for the two-bay longitudinal crack panel correlated well with the test results. Analysis activity conducted by the IAS team strongly indicates that current analysis tools predict integral structural behavior as accurately as built-up structure. The cost study results indicated that, compared to built-up fabrication methods, high-speed machining structure from aluminum plate would yield a recurring cost savings of 61%. Part count dropped from 78 individual parts on a baseline panel to just 7 parts for machined IAS structure.
Author
Feasibility Analysis; Computer Programs; Cost Reduction; Mechanical Properties; Manufacturing; Airframes

20000051494 Dayton Univ. Research Inst., Research Inst., OH USA
Fuel and Fuel System Materials Compatibility Test Program for a JP-8+100 Fuel Additive. Volume 1. Betzdearborn Spec-Aid 8Q462 Thermal Stability Additive Package *Final Report, 1 Jan. 1992-1 Jan. 1999*
Kalt, D. H.; Zabarnick, S.; Anderson, S. D.; Liberio, P. D.; Mar. 1999; 79p; In English
Contract(s)/Grant(s): F33615-92-C-2207; AF Proj. 3048
Report No.(s): AD-A375824; AFRL-PR-WP-TR-2000-2021; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes a program to test the compatibility of aircraft fuel system materials with a JP-8 fuel containing a new thermal stability additive package. The JP-8 fuel containing this new additive package is commonly referred to as JP-8+100. The "+100" refers to the expected 100 degree F increase in thermal stability range of the fuel containing the additive over the thermal stability range of JP-8 fuel. In this test report, the effects of fuel containing BetzDearborn Spec-Aid 8Q462 additive package on aircraft fuel system's materials. The BetzDearborn Spec-Aid 8Q462 fuel additive package incorporates a dispersant, a metal deactivator, and an antioxidant compound. These compounds reduce the rate of oxidation and/or inhibit the formation of bulk and surface deposits at higher temperatures.
DTIC
Aircraft Fuel Systems; JP-8 Jet Fuel; Oxidation; Additives

20000051552 Office National d'Etudes et de Recherches Aerospatiales, Dept. DEFA, Palaiseau, France
New Fluorinated Binder Solid Propellants for Controllable Rocket Motors, Solid Fuel Ramjets and Ducted Rockets
Fourest, B., Office National d'Etudes et de Recherches Aerospatiales, France; Masson, C., Office National d'Etudes et de Recherches Aerospatiales, France; Vigot, C., Office National d'Etudes et de Recherches Aerospatiales, France; Perut, C., Societe Nationale des Poudres et Explosifs, France; Cristofoli, B., Societe Nationale des Poudres et Explosifs, France; Small Rocket Motors and Gas Generators for Land, Sea and Air Launched Weapon Systems; April 2000, pp. 27-1 - 27-14; In English; See also 20000051537; Copyright Waived; Avail: CASI; A03, Hardcopy

ONERA and SNPE have developed a new highly fluorinated binder (fluorine content is greater than = 50%) with high density (d is greater than = 1.7). This binder could be used to make various energetic materials : Reactive Armor, solid propellants with high-pressure deflagration limit (Pdl), fuel rich solid propellants for ducted rocket and ramjet solid fuels. The chemical nature of this binder (high proportion of fluorine and oxygen) used with an ammonium perchlorate loading (70 is less than or equal to AP is less than or equal to 79%), is interesting to obtain oxidizing solid propellants which have high-pressure deflagration limits

(1 is less than or equal to Pdl is less than or equal to 3 MPa). In association with a fuel-rich gas generator, it is possible to conceive controllable rocket motors. The fuel-rich gas is injected in the fluorinated propellant motor through a valve which controls the ignition of the grain and the different stages of the motor thrust. A great number of tests has been successfully performed to demonstrate the real interest of this propulsion system. Fluorinated binders also improve the combustion efficiency of boron and boron carbide in airbreathing combustion chambers. Combustion mechanism studies of fluorinated binder with fuel filler have shown the very strong reactivity of this binder with metals like magnesium and aluminium. New solid fuels and fuel-rich propellants have been developed with fillers of metallic powder mixtures. These compositions have high ablation rates and adapted burning rates for unchoked gas generator with radial grain ("rustique" ducted rocket). This paper describes basic studies (e.g. combustion mechanism) performed and possibilities to use this new generation of energetic materials in these two domains of propulsion.
Author
Fluorine; Solid Rocket Binders; Fillers; Ducted Rocket Engines; Ramjet Engines; Rocket Engine Control; Solid Propellants

12
ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention.

20000057194 Technische Univ., Ship Hydromechanics Lab., Delft, Netherlands
Scaling of Air Cushion Dynamics
Moulijn, J. C., Technische Univ., Netherlands; Jul. 29, 1998; 22p; In English
Report No.(s): PB2000-104671; Copyright; Avail: Issuing Activity

The goal of this report is to investigate how one can scale the dynamics of an air cushion correctly. An equation which describes the dynamics of an air cushion is presented. This equation is used to find the correct scale factors for the terms that occur in this equation. First the scaling of the stiffness of the air cushion is treated. Three alternative ways to achieve the correct scale factor for the cushion stiffness are investigated: a reduction of the ambient pressure, an increase of the cushion volume and mounting a flexible membrane (i.e. diaphragm) on top of the air cushion. Then the scaling of the air supply system and air leakage are investigated. Finally this report presents a computational and experimental analysis of the diaphragm technique.
NTIS
Ground Effect Machines; Ships; Hydrodynamics

20000054795 Thomson Training and Simulation Ltd., Crawley, UK
Developments in Data Communications and Their Effects on Simulation
Brash, P., Thomson Training and Simulation Ltd., UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 19.1 - 19.9; In English; See also 20000054782; Copyright; Avail: Issuing Activity

In recent years, data communication has played a pivotal role in airline operations. The transfer of data using conventional radio and satellite communications channels has enabled airlines to relay information between flight deck crew and airline ground stations such as a maintenance base, flight operations centre, or passenger office relatively quickly and inexpensively. Considering the ability to provide reliable data communications on virtually any aircraft, and the potential cost saving benefits arising thereof, the reasons behind the rapid growth in data communications systems such as FANS and ADS become apparent. More recently, communications have evolved between flight deck crew and air traffic controller, vis-a-vis FANS (Future Air Navigation System). Today it is possible for an air traffic controller to communicate promptly and clearly with a flight deck crew, and track an aircraft accurately anywhere in the world. As a result, new air traffic management procedures are being introduced. ADS-B, seen as an alternative Collision Avoidance System to TCAS, relies upon air-to-air data communication in order to provide situational awareness, and is under evaluation by operators in the USA. This paper discusses some of the features of data communication that are or will be of relevance to current and future simulator training, such as the potential impact upon simulation resulting from the forthcoming introduction of ATN (the Aeronautical Telecommunications Network). The need for flight deck crew training in order to ensure correct use of existing facilities, and the benefits of suitably equipped simulators to instructors, maintenance personnel, and data communication system developers will be demonstrated. Finally, the paper considers the benefit and some of the issues involved in connecting a simulator to the real-world data communication network.
Author
Data Transmission; Aircraft Communication; Channels (Data Transmission); Civil Aviation; Communication Networks; Connectors; Flight Training; Ground Stations; Management Methods; Radio Communication; Training Simulators

20000053468 NASA Langley Research Center, Hampton, VA USA
Some Notes on Sparks and Ignition of Fuels
Fisher, Franklin A., Lightning Technologies, Inc., USA; March 2000; 40p; In English
Contract(s)/Grant(s): SAA1-435; RTOP 522-14-21-51
Report No.(s): NASA/TM-2000-210077; L-17966; NAS 1.15:210077; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report compliments a concurrent analysis of the electromagnetic field threat to the fuel system of a transport aircraft. The accompanying effort assessed currents, voltages and power levels that may be induced upon fuel tank wiring from radio transmitters (inside and outside the aircraft). In addition to this, it was also essential to determine how much voltage, current, or power is required to create a fuel-vapor ignition hazard. The widely accepted minimum guideline for aircraft fuel-vapor ignition is the application of a 0.2 millijoule energy level. However, when considering radio frequency (RF) sources, this guideline is seriously inadequate. This report endeavors to bridge the gap between a traditional understanding of electrical breakdown, heating and combustion; and supplement the knowledge with available information regarding aircraft fuel-vapor ignition by RF sources
Author
Aircraft Fuels; Fuel Systems; Electromagnetic Fields

20000045990 McDonnell-Douglas Corp., Long Beach, CA USA
Full Configuration Force and Moment Calculations Using Multiblock CFL3D on HSCT Configurations
Martin, Grant L., McDonnell-Douglas Corp., USA; Narducci, Robert P., McDonnell-Douglas Corp., USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 44-112; In English; See also 20000045988; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

During the past year, the McDonnell Douglas Corporation (MDC) has made large strides in Computational Fluid Dynamics (CFD) analysis of increasingly complex HSCT configurations using both serial and parallel computational platforms. While tools for grid generation and analysis on serial computers have remained relatively unchanged, a new gridding strategy has been employed to obtain Navier-Stokes analyses of HSCT configurations which include the wing, body, nacelles, diverters, and empennage. Additionally, with the promising efficiency of parallel machines, MDC has contributed to the development of CFL3Dhp, a parallel version of CFL3D for the IBM SP-2. Presented herein are full configuration Euler and Navier-Stokes solutions obtained using CFL3D on the NAS C-90 and IBM SP-2. With the objectives of validating CFL3D for supersonic cruise calculatio s on several platforms, CFD results for the Reference H and Technology Concept Airplane (TCA) configurations are presented in a build-up fashion. The build-up fashion entails analyzing the simplest of configuration first, the wing/body (W/B) followed by the additional complexity of the empennage (W/B/E), then nacelles and diverters (W/B/N/D), and finally the entire configuration (W/B/N/D/E). A thorough build-up has been performed on the Reference H configuration, while the TCA build-up work is still in progress. To assist in the validation, a number of comparisons are made to available experimental data from the NASA Langley Unitary Plan Wind Tunnel (UPWT).
Author
Civil Aviation; Multiblock Grids; Supersonic Transports; Wind Tunnel Tests; Body-Wing and Tail Configurations; Computational Fluid Dynamics; Pitching Moments

20000045997 NASA Langley Research Center, Hampton, VA USA
Forced Transition Techniques on HSCT Configurations
Wahls, Richard A., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; Owens, Lewis R., Jr., NASA Langley Research Center, USA; 1997 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 477-508; In English; See also 20000045988; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objectives of this effort were to determine (if possible) the best method: 1) for forcing the boundary layer to transition, 2) for assessing trip effectiveness, 3) for quantifying trip drag, 4) for testing at Reynolds numbers per foot from 5 million to maximum available rather than I to 5 million, and 5) for boundary layer state determination.
Derived from text
Boundary Layer Transition; Supersonic Transports; Aerodynamic Configurations; Civil Aviation; Loads (Forces)

20000053026 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Time Accurate CFD Analysis of Ship Air Wake with Coupled V-22 Flow
Polsky, Susan; Bruner, Chris; Jan. 2000; 2p; In English
Report No.(s): AD-A375813; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The research objectives of this task are three-fold. The first objective is to predict the unsteady air wake over Navy class ships. A database of important air wake conditions is thus developed which can then be incorporated into a manned flight simulator. The improved simulation environment can then ultimately be used to train pilots and develop shipboard flight envelopes that would otherwise only be developed with expensive at-sea trials with real aircraft, crew and ships. The second objective is to determine the time-varying affect of the air wake generated by a ship on a hovering rotorcraft, in this case the V-22, and vice-versa. This analysis is used to analyze the causes of increased pilot workload at problem landings spots. The third objective is to provide an accurate and efficient design tool to aid in the development of improved air vehicle/ship interface designs for future Navy ships. DTIC

Computational Fluid Dynamics; Unsteady Flow; Air Water Interactions; Flight Crews; Rotary Wing Aircraft; Ships; Wakes

20000054669 NASA Glenn Research Center, Cleveland, OH USA

Heat Transfer Measurements and Predictions on a Power Generation Gas Turbine Blade

Giel, Paul W., DYNACS Engineering Co., Inc., USA; Bunker, Ronald S., General Electric Co., USA; VanFossen, G. James, NASA Glenn Research Center, USA; Boyle, Robert J., NASA Glenn Research Center, USA; April 2000; 20p; In English; 45th; 45th International Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany

Contract(s)/Grant(s): NAS3-98008; RTOP 523-26-13

Report No.(s): NASA/TM-2000-210021; NAS1.15:210021; E-12218; ASME-2000-GT-0209; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Detailed heat transfer measurements and predictions are given for a power generation turbine rotor with 129 deg of nominal turning and an axial chord of 137 mm. Data were obtained for a set of four exit Reynolds numbers comprised of the design point of 628,000, -20%, +20%, and +40%. Three ideal exit pressure ratios were examined including the design point of 1.378, -10%, and +10%. Inlet incidence angles of 0 deg and +/-2 deg were also examined. Measurements were made in a linear cascade with highly three-dimensional blade passage flows that resulted from the high flow turning and thick inlet boundary layers. Inlet turbulence was generated with a blown square bar grid. The purpose of the work is the extension of three-dimensional predictive modeling capability for airfoil external heat transfer to engine specific conditions including blade shape, Reynolds numbers, and Mach numbers. Data were obtained by a steady-state technique using a thin-foil heater wrapped around a low thermal conductivity blade. Surface temperatures were measured using calibrated liquid crystals. The results show the effects of strong secondary vortical flows, laminar-to-turbulent transition, and also show good detail in the stagnation region.

Author

Aerodynamic Heat Transfer; Aerothermodynamics; Gas Turbines; Heat Transfer; Rotors; Three Dimensional Models; Turbine Blades; Computational Fluid Dynamics; Transonic Flow; Wind Tunnel Tests

20000057304 NASA Glenn Research Center, Cleveland, OH USA

Generation of Bubbly Suspensions in Low Gravity

Nahra, Henry K., NASA Glenn Research Center, USA; Hoffmann, Monica I., NASA Glenn Research Center, USA; Hussey, Sam, NASA Glenn Research Center, USA; Bell, Kimberly R., Pennsylvania State Univ., USA; [2000]; 12p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-0854; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Generation of a uniform monodisperse bubbly suspension in low gravity is a rather difficult task because bubbles do not detach as easily as on Earth. Under microgravity, the buoyancy force is not present to detach the bubbles as they are formed from the nozzles. One way to detach the bubbles is to establish a detaching force that helps their detachment from the orifice. The drag force, established by flowing a liquid in a cross or co-flow configuration with respect to the nozzle direction, provides this additional force and helps detach the bubbles as they are being formed. This paper is concerned with studying the generation of a bubbly suspension in low gravity in support of a flight definition experiment titled "Behavior of Rapidly Sheared Bubbly Suspension." Generation of a bubbly suspension, composed of 2 and 3 mm diameter bubbles with a standard deviation is less than 10% of the bubble diameter, was identified as one of the most important engineering/science issues associated with the flight definition experiment. This paper summarizes the low gravity experiments that were conducted to explore various ways of making the suspension. Two approaches were investigated. The first was to generate the suspension via a chemical reaction between the continuous and dispersed phases using effervescent material, whereas the second considered the direct injection of air into the continuous phase. The results showed that the reaction method did not produce the desired bubble size distribution compared to the direct injection of bubbles. However, direct injection of air into the continuous phase (aqueous salt solution) resulted in uniform bubble-diameter distribution with acceptable bubble-diameter standard deviation.

Author

Mass Transfer; Heat Transfer; Gas Injection; Bubbles; Suspension Systems (Vehicles); DC 9 Aircraft

20000053016 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
High Fidelity Installed Sensor Testing Using an Infrared Scene Projector
Joyner, Tom; Robinson, Richard; Jan. 2000; 4p; In English
Report No.(s): AD-A375780; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Modern day military aircraft depend on a diversity of electromagnetic sensors to provide both aircraft and pilot with unparalleled battle space awareness and engagement opportunity. Missions involving reconnaissance, search and rescue, time vision navigation/evasion, target acquisition, target search and track, missile warning, and terminal missile homing all require the most advanced sensors available to provide the war fighter with the greatest possible tactical advantage. The latest generation of military aircraft rely heavily on these multispectral sensors as an integrated component of the flight control and mission control avionics. Often, overall mission performance is directly linked to the combined performance of the onboard mission critical sensors. Therefore, exhaustive sensor testing in this integrated sensor/avionics environment is mandatory.
DTIC
Infrared Detectors; Avionics; Ultraviolet Detectors; Scene Generation; Flight Control; Navigation

20000048404 Indian Space Research Organization, Satellite Centre, Bangalore, India
A Novel Mechanism Using Shape Memory Alloy to Drive Solar Flaps of the INSAT-2E Satellite
Viswanatha, N., Indian Space Research Organization, India; Murali, T. P., Indian Space Research Organization, India; 34th Aerospace Mechanisms Symposium; May 2000, pp. 239-249; In English; See also 20000048380; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An innovative drive mechanism developed by Indian Space Research Organization for deployment and positioning of solar flaps is successfully working on the geosynchronous multi-purpose communication satellite INSAT-2E. The drive mechanism works on linear actuators made of Shape Memory Alloy (SMA) wires and is capable of driving solar flaps in 2-degree steps, like a stepper motor. This paper describes the design of the mechanism, qualification testing and on-orbit experience.
Author
Linearity; Actuators; Shape Memory Alloys; Wire; Solar Arrays; Solar Energy Conversion; Flaps (Control Surfaces)

20000050271 Department of the Navy, Washington, DC USA
Adjustable Electric Motor Bearing System
Cohen, Edward I., Inventor; Purnell, John G., Inventor; Dec. 14, 1999; 4p; In English; Supersedes US-Patent-Appl-SN-08988037, AD-D019440.
Patent Info.: Filed 10 Dec. 1997; US-Patent-Appl-SN-08,988,037; US-Patent-6,000,851
Report No.(s): AD-D019640; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The parameters of a rotor bearing assembly are readily changed to facilitate evaluation, determination and establishment of optimum hearing clearance and rotor bearing adjustment to minimize noise and vibration, by an arrangement which includes seating of solid deflection pads positioned within a carrier on replaceable adjustment shims and retention of the pads and shims seated in adjusted positions by means of hold-down screws.
DTIC
Electric Motors; Stators; Rotors; Bearings; Patents

20000055761 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The MEMS Knudsen Compressor as a Vacuum Pump for Space Exploration Applications
Vargo, S. E., Jet Propulsion Lab., California Inst. of Tech., USA; Muntz, E. P., University of Southern California, USA; Tang, W. C., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 11p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several lander, probe and rover missions currently under study at the Jet Propulsion Laboratory (JPL) and especially in the Microdevices Laboratory (MDL) Center for Space Microelectronics Technology, focus on utilizing microelectromechanical systems (MEMS) based instruments for science data gathering. These small instruments and NASA's commitment to "faster, better, cheaper" type missions has brought about the need for novel approaches to satisfying mission requirements. Existing in-situ instrument systems clearly lack novel and integrated methods for satisfying their vacuum needs. One attractive candidate for a MEMS vacuum pump is the Knudsen Compressor, which operates based on thermal transpiration. Thermal transpiration describes gas flows induced by temperature differences maintained across orifices, porous membranes or capillary tubes under rarefied conditions. This device has two overwhelmingly attractive features as a MEMS vacuum pump - no moving parts and no fluids. An initial estimate of a Knudsen Compressor's pumping power requirements for a surface atmospheric sampling task on Mars is less than 80 mW, significantly below than alternative pumps. Due to the relatively low energy use for this task and the

applicability of the Knudsen Compressor to other applications, the development of a Knudsen Compressor utilizing MEMS fabrication techniques has been initiated. This paper discusses the initial fabrication of a single-stage MEMS Knudsen Compressor vacuum pump, provides performance criteria such as pumping speed, size, energy use and ultimate pressure and details vacuum pump applications in several MDL related in-situ instruments.
Author
Microelectromechanical Systems; Microelectronics; Fabrication; Compressors; Vacuum Pumps; Vacuum; Knudsen Flow

20000057289 Northwestern Univ., Center for Quality Engineering and Failure Prevention, Evanston, IL USA
Fiber-Optic Ultrasound Sensors for Smart Structures Applications *Final Report, 1 Jan. 1996 - 30 Sep. 1999*
Krishnaswamy, Sridhar; Achenbach, Jan D.; Jan. 25, 2000; 16p; In English
Contract(s)/Grant(s): F49620-96-1-0170
Report No.(s): AD-A376112; AFRL-SR-BL-TR-00-0101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The project addressed the development of an important nondestructive evaluation tool utilizing fiber-optic ultrasonic sensors which can be permanently mounted in inaccessible regions of an airframe so as to facilitate flaw detection and characterization. Over the course of this project, several types of intrinsic fiber-optic ultrasound sensors were developed. These include the following fiber-optic ultrasound receivers: Fabry-Perot (FOFP) sensors, Sagnac Ultrasound Sensor (SUS), and Bragg-Grating Ultrasound (BGU) sensors. Fiber-optic laser ultrasound generator (FLUG) systems were also developed. Applications of these fiber-optic ultrasound systems in process monitoring as well as flaw detection have been demonstrated.
DTIC
Fiber Optics; Aircraft Maintenance; Acoustic Emission

20000056198 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Buckling of Imperfect Anisotropic Shells with Elastic Edge Supports under Combined Loading, Part 1, Theory and Numerical Analysis
Arbocz, J.; deVries, J.; Hol, J. M. A. M.; Sep. 1998; 162p; In English
Report No.(s): PB2000-103707; No Copyright; Avail: National Technical Information Service (NTIS)

All modern aerospace structures are subject to weight-restrictions and must satisfy severe reliability criteria. Thus the aerospace community is always looking for ways to produce lighter and more reliable structures. Because thin walled stiffened shells exhibit very favorable strength over weight ratios they are often used in aerospace applications. Initially they were made mostly of light-weight metal alloys but recently bonded sandwich constructions with honeycomb core and advanced composite design have also been proposed. Unfortunately, thin walled shells are prone to buckling instabilities. In this paper a rigorous solution is presented for the case of stiffened layered composite shells with general axisymmetric and asymmetric imperfections under combined axial compression, internal or external pressure and torsion, where the edge supports are provided by symmetrical or unsymmetrical elastic rings. The analysis is based on a combination of the nonlinear Donnell type anisotropic imperfect shell equations with the ring equations of Cohen.
NTIS
Anisotropic Shells; Supports; Aircraft Structures; Composite Structures; Aircraft Design; Spacecraft Design; Elastic Buckling

20000057405 Virginia Polytechnic Inst. and State Univ., Aerospace and Ocean Engineering Dept., Blacksburg, VA USA
Compression Strength of Composite Primary Structural Components *Final Report, 1 Feb. 1998 - 18 Jan. 2000*
Johnson, Eric R., Virginia Polytechnic Inst. and State Univ., USA; Jun. 01, 2000; 4p; In English
Contract(s)/Grant(s): NAG1-2035; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The focus of research activities under NASA Grant NAG-1-2035 was the response and failure of thin-walled structural components. The research is applicable to the primary load carrying structure of flight vehicles, with particular emphasis on fuselage and wing'structure. Analyses and tests were performed that are applicable to the following structural components an aft pressure bulkhead, or a composite pressure dome, pressure cabin damage containment, and fuselage frames subject to crash-type loads.
Derived from text
Composite Structures; Loads (Forces); Thin Walls; Fuselages; Structural Design

13
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology.

20000052706 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The GRACE Mission: Meeting the Technical Challenges
Davis, E. S., Jet Propulsion Lab., California Inst. of Tech., USA; Dunn, C. E., Jet Propulsion Lab., California Inst. of Tech., USA; Stanton, R. H., Jet Propulsion Lab., California Inst. of Tech., USA; Thomas, J. B., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English
Report No.(s): IAF-99-B.2.05; No Copyright; Avail: Issuing Activity; Abstract Only

The Gravity Recovery and Climate Experiment (GRACE) Mission is scheduled for launch in June 2001. Within the first year of the GRACE Mission, the project has a minimum science requirement to deliver a new model of the Earth's static geoid with an error of less than 1 cm to spherical harmonic degree seventy (70). However, the performance of the GRACE Mission is designed to exceed this minimum requirement by a factor of 25 or more. For spherical harmonic degrees of up to 40, we expect to improve the current knowledge of the gravity field by one thousand (1000x). The GRACE Mission uses the satellite-to-satellite tracking (SST) technique. The twin GRACE satellites are the instruments that measure the nonuniformities in the Earth's gravity field. Nonuniformities in the gravity field cause the relative distance between the centers-of-mass of the two satellites to vary as they fly over the Earth. Atmospheric drag is the largest non-gravitational disturbing force. Drag is measured and will be used to correct changes in the satellite-to-satellite range measured by an SST microwave link. The microwave link will measure changes in the range between the two GRACE satellites with an error approaching 1 micron. We will discuss how these instrumentation requirements affect the configuration, the mass balance, the thermal control and the aerodynamic design of the satellites, and the design of the microwave SST link and the accelerometer. Finally, the question of how noise in these components limits the overall accuracy of the gravity models will be addressed.
Author
Aerodynamics; Earth Gravitation; Gravitational Fields; Satellite-to-Satellite Tracking; Nonuniformity

20000055754 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Relating Vegetation Aerodynamic Roughness Length to Interferometric SAR Measurements
Saatchi, Sassan, Jet Propulsion Lab., California Inst. of Tech., USA; Rodriquez, Ernesto, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, we investigate the feasibility of estimating aerodynamic roughness parameter from interferometric SAR (INSAR) measurements. The relation between the interferometric correlation and the rms height of the surface is presented analytically. Model simulations performed over realistic canopy parameters obtained from field measurements in boreal forest environment demonstrate the capability of the INSAR measurements for estimating and mapping surface roughness lengths over forests and/or other vegetation types. The procedure for estimating this parameter over boreal forests using the INSAR data is discussed and the possibility of extending the methodology over tropical forests is examined.
Author
Interferometry; Vegetation; Synthetic Aperture Radar; Surface Roughness; Length; Aerodynamics

20000047269 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. for Physics of the Atmosphere, Oberpfaffenhofen, Germany
Impact of Aircraft Emissions on the Global Atmosphere
Sausen, Robert, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Schumann, Ulrich, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 7-1 - 7-34; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Aviation is a very fast growing economic sector. For instance, in 1998 the number of passengers travelling with Deutsche Lufthansa grew by 9% relative to the previous year. Globally the annual increase rate in air transportation is more than 5%. The rapidly increasing demand for air transport outpaces technological improvements in aircraft and improvements in air traffic management systems: the mean annual increase rate of fuel burn was 2.2% for the years 1985 to 1995. Similar increase rates are expected for the future. Aircraft emit gases (CO2, H2O, NO, SO2, UHC, etc.), aerosols (e.g., soot) and aerosol precursors (e.g., SO3, H2SO4). Hence, aircraft modify the composition of the atmosphere either directly due to these emissions or indirectly via chemical processes, e.g., NO, modifies the ozone concentration. The main concern related with these emissions is the potential for climate change by perturbing the Earth's radiative budget as a result of several processes: (1) the emission of radiatively active

substances (e.g. CO2 or H2O); (2) the emission of chemical species which produce or destroy radiatively active substances (like NOx, which modifies the O3 concentration, or SO2, which oxidizes to sulfate aerosols); (3) the emission of substances (e.g. H2O, soot) which trigger the generation of additional clouds (e.g. contrails). Due to the internal variability of the atmosphere, it is extremely difficult to detect the climatic impact of a single economic sector in climate observations or in simulations with comprehensive climate models. Therefore we consider the radiative forcing (RF) associated with various perturbations of the atmospheric composition. RF is known to be a good predictor of global climate change in terms of variables like the global mean surface temperature change or mean sea level rise. On average the global mean surface temperature increases by 0.6 K per 1 Wm(exp -2) of RF. In the following we consider various individual contributions to the radiative forcing and concentrate on 1992 and 2050. While the current and past emissions of aviation are reasonably well known, we have no reliable forecasts of the future. Hence, we make use of emission scenarios, which have been developed for various economic and technological assumptions. We study in greater detail the aviation scenario Fa1 that makes similar economic assumptions as the IPCC scenario IS92a for all anthropogenic emissions. In the latter scenario the CO2 concentration increases by 0.6% annually. The aviation scenario Fa1 assumes a mean annual increase rate of 1.7% for the fuel burn until 2050.
Derived from text
Exhaust Gases; Exhaust Emission; Atmospheric Composition; Climate Change; Air Transportation; Radiative Transfer

20000053513 North Carolina State Univ., Dept. of Marine, Earth and Atmospheric Sciences, Raleigh, NC USA
Numerical Modeling Studies of Wake Vortex Transport and Evolution Within the Planetary Boundary Layer *Final Report, 7 Jan. 1994 - 6 Apr. 2000*
Lin, Yuh–Lang, North Carolina State Univ., USA; Arya, S. Pal, North Carolina State Univ., USA; Kaplan, Michael L., North Carolina State Univ., USA; Han, Jongil, North Carolina State Univ., USA; May 2000; 280p; In English
Contract(s)/Grant(s): NCC1-188; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The fundamental objective of this research is study behavior of aircraft wake vortices within atmospheric boundary layer (ABL) in support of developing the system, Aircraft VOrtex Spacing System (AVOSS), under NASA's Terminal Area Productivity (TAR) program that will control aircraft spacing within the narrow approach corridors of airports. The purpose of the AVOSS system is to increase airport capacity by providing a safe reduction in separation of aircraft compared to the now-existing flight rules. In our first funding period (7 January 19994 - 6 April 1997), we have accomplished extensive model development and validation of ABL simulations. Using the validated model, in our second funding period (7 April 1997 - 6 April 2000) we have investigated the effects of ambient atmospheric turbulence on vortex decay and descent, Crow instability, and wake vortex interaction with the ground. Recognizing the crucial influence of ABL turbulence on wake vortex behavior, we have also developed a software generating vertical profiles of turbulent kinetic energy (TKE) or energy dissipation rate (EDR), which are, in turn, used as input data in the AVOSS prediction algorithms.
Author
Research; Vortices; Turbulence Effects; Aircraft Wakes; Atmospheric Boundary Layer; Planetary Boundary Layer

20000056078 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The DC-8 Submillimeter-Wave Cloud Ice Radiometer
Walter, Steven, Jet Propulsion Lab., California Inst. of Tech., USA; Batelaan, Paul, Jet Propulsion Lab., California Inst. of Tech., USA; Siegel, Peter, Jet Propulsion Lab., California Inst. of Tech., USA; Evans, K. Franklin, Colorado Univ., USA; Evans, Aaron, Colorado Univ., USA; Balachandra, Balu, Swales Aerospace, USA; Gannon, Jade, Swales Aerospace, USA; Guldalian, John, Swales Aerospace, USA; Raz, Guy, Swales Aerospace, USA; Shea, James, Swales Aerospace, USA; Smith, Christopher, Swales Aerospace, USA; Thomassen, John, Swales Aerospace, USA; [2000]; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Submillimeter-wave cloud ice radiometry is an innovative technique for determining the amount of ice present in cirrus clouds, measuring median crystal size, and constraining crystal shape. The radiometer described in this poster is being developed to acquire data to validate radiometric retrievals of cloud ice at submillimeter wavelengths. The goal of this effort is to develop a technique to enable spaceborne characterization of cirrus, meeting key climate modeling and NASA measurement needs.
Derived from text
Cirrus Clouds; Ice; Radiometers; Submillimeter Waves; DC 8 Aircraft; Mechanical Engineering

20000052705 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Altimeter Data for Operational Use in the Marine Environment
Digby, Susan, Jet Propulsion Lab., California Inst. of Tech., USA; Antczak, Thomas, Jet Propulsion Lab., California Inst. of Tech., USA; Leben, Robert, Colorado Univ., USA; Born, George, Colorado Univ., USA; Barth, Suzanne, Colorado Univ., USA; Cheney,

Robert, National Oceanic and Atmospheric Administration, USA; Foley, David, National Oceanic and Atmospheric Administration, USA; Goni, Gustavo Jorge, National Oceanic and Atmospheric Administration, USA; Jacobs, Gregg, Naval Research Lab., USA; Shay, Nick, Miami Univ., USA; [1999]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

TOPEX/Poseidon has been collecting altimeter data continuously since October 1992. Altimeter data have been used to produce maps of sea surface height, geostrophic velocity, significant wave height, and wind speed. This information is of proven use to mariners as well as to the scientific community. Uses of the data include commercial and recreational vessel routing, ocean acoustics, input to geographic information systems developed for the fishing industry, identification of marine mammal habitats, fisheries management, and monitoring ocean debris. As with sea surface temperature data from the Advanced Very High Resolution Radiometer (AVHRR) in the late 1980s and early 1990s, altimeter data from TOPEX/Poseidon and ERS-1 and -2 are in the process of being introduced to the marine world for operational maritime use. It is anticipated that over the next few years companies that specialize in producing custom products for shipping agencies, fisheries and yacht race competitors will be incorporating altimeter data into their products. The data are also being incorporated into weather and climate forecasts by operational agencies both in the US and Europe. This paper will discuss these products, their uses, operational demonstrations and means of accessing the data.

Author

Altimeters; Data Acquisition; Ocean Data Acquisitions Systems; Marine Environments; Mapping; Ocean Surface; Sea Surface Temperature; Geostrophic Wind; Wind Velocity

14
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions.

20000052125 Civil Aeromedical Inst., Oklahoma City, OK USA

The Evaluation of In-Flight Medical Care Aboard Selected US Air Carriers: 1996 to 1997 *Final Report*

Dejohn, Charles A., Civil Aeromedical Inst., USA; Veronneau, Stephen J. H., Civil Aeromedical Inst., USA; Wolbrink, Alex M., Civil Aeromedical Inst., USA; Larcher, Julie G., Civil Aeromedical Inst., USA; Smith, David W., Oklahoma Univ., USA; Garrett, Joan, MedAire, Inc., USA; May 2000; 32p; In English

Contract(s)/Grant(s): DTFA02-97-P-53665; AM-B-97-TOX-203

Report No.(s): DOT/FAA/AM-00/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Medical care in-flight and the FAA-mandated medical kit have been studied for many years. This study includes a detailed correlation between in-flight medical care, patient response in-flight, and post-flight follow-up, in an effort to evaluate in-flight medical care delivery on US airlines and re-evaluate the FAA-mandated in-flight medical kit. A survey of five US domestic air carriers from October 1, 1996, to September 30, 1997, showed 1132 in-flight medical incidents. These airlines accounted for approximately 22% of scheduled US domestic enplanements during the period. There was good overall agreement between in-flight and post-flight diagnoses (70% of cases), and passenger condition improved in a majority of cases (60%), suggesting that in-flight diagnoses were generally accurate and treatment was appropriate. Results indicated that bronchodilator inhalers, oral antihistamines, and non-narcotic analgesics, all of which were obtained from other passengers, were used frequently enough to support a suggestion to include them in the medical kit.

Author

Airline Operations; Air Transportation; In-Flight Monitoring; Crew Procedures (Inflight); Medical Services

20000053012 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Improving Aircrews' Crosscheck of Flight Instruments when Using NVGs. HFM Workshop on "What is Essential for Virtual Reality to Meet Military Performance Goals"

Antonio, Joseph; Jan. 2000; 2p; In English

Report No.(s): AD-A375769; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Current ground-based introductory night vision goggle (NVG) training consists of classroom lectures, hands-on adjustment training, terrain board demonstrations, and, for a few platforms, simulator training. The content of the lectures was developed jointly between the USAF and USN and is standardized for all platform types. NVG video sequences of actual events are integrated with the lectures to support verbal descriptions of operationally relevant concerns, such as illusion and misperceptions. Terrain boards are used to demonstrate visual phenomena specific to the NVG image resulting from the intensification process.

NVG-capable simulators provide for good "system integration" training (e.g., looking beneath the NVG at cockpit instruments, scanning the outside scene, etc.), but due to inadequacies with the simulated imagery, there are serious limitations to "visual" training. Consequently, terrain board demonstrations continue to be the best method of demonstrating many of the NVG image characteristics. There is currently no "table-top" computer training available for reinforcing some of the more important NVG lessons learned from operational experience and mishaps.
DTIC
Virtual Reality; Flight Crews; Flight Instruments; Goggles; Night Vision

20000054784 Defence Procurement Agency, Eurofighter Requirements, Bristol, UK
Interactive Hybrid Environment Training
Sullivan, John M., Defence Procurement Agency, UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 3.1 - 3.8; In English; See also 20000054782; Copyright; Avail: Issuing Activity

The UK requirement for Eurofighter Typhoon Aircrew Synthetic Training Aids (ASTA) was determined by 2 Training Needs Analyses (TNAs). Subsequent to the conclusion of these comprehensive studies, the doctrine of the UK Armed Forces was fundamentally reviewed to reflect the emerging perception of the military capability demanded by the change in global politics, alliances and attitudes that accompanied the end of the Cold War. Accordingly, an appraisal of the previous TNAs was conducted during 1999, to ensure their continued relevance. In attempting to determine the most appropriate medium with which to address the total training task for EF pilots, it became apparent that there were fundamental limitations in the training that can be delivered by both real and synthetic regimes in isolation. However, a capability to merge these training regimes could mitigate these inherent weaknesses and draw upon the strengths of each to create a holistic training environment. This paper represents the personal vision of the author and does not reflect current MOD procurement or training policy. Although the EF programme is used consistently for illustrative purposes, the concept is equally applicable to all modem, high-performance combat aircraft.
Author
Aircraft Performance; Education; Policies; Tasks; Training Analysis

20000054806 Thomson Training and Simulation Ltd., Crawley, UK
Collective Training: Virtually a Reality or Still Over the Horizon?
Aylward, Mark, Thomson Training and Simulation Ltd., UK; Flight Simulation - The Next Decade: Proceedings; [2000], pp. 31.1 - 31.9; In English; See also 20000054782; Copyright; Avail: Issuing Activity

Collective training has been talked about as the future direction of military synthetic training for the past few years. Most UK flight simulation programmes contracted in the last five years have had some form of networking requirement included. Industry has invested in and delivered real time networking technologies. In the ground training environment CATT continues development. In the US the No-Can-Pay milestone for HLA compliance passed at the start of 1999. The No-Can-Play milestone will be passed in 2001. But are we really any closer to realising the 'train-as-we-fight' ethic in the UK air domain? What exactly do collective training and DIS or HLA compliance mean? Can this capability really be retrofitted to existing systems? Are we prepared for the implications of delivering collective training? How does collective training fit in with the supply of training services via the Public-Private-Partnership? Should we invest in technical developments to support a capability, which may rarely (or never) be used in anger? Just what will it take to make air domain collective training in the UK a reality? This paper will examine the issues raised above, attempt to answer some of the questions and propose some alternatives, which may come to fruition in the next decade.
Author
Real Time Operation; Flight Simulation; Networks; Teams; Training Analysis

20000057291 York Univ., Ontario Canada
Visual and Auditory Sensitivities and Discriminations *Final Report, 15 Dec. 1996 - 14 Dec. 1999*
Regan, David; Feb. 2000; 106p; In English
Contract(s)/Grant(s): F49620-97-1-0051
Report No.(s): AD-A376091; AFRL-SR-BL-TR-00-0124; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Errors in judging absolute time to collision using monocular information alone range from 2 to 12% and from 2.5 to 10% using binocular information alone, but only 1.3 to 2.7% using the combination. For small targets, judgements are based entirely on binocular information. Individuals make large errors in judging absolute time to collision with a rotating nonspherical object

when judgements are based on monocular information, but not when binocular information is provided. When simulating closure with a textured object, systematic errors in judging time to collision can occur if the rates of expansion of texture element size and object size are not matched exactly. Exposure to expanding images produces errors in judging time to collision that may cause errors in NOE flight and may be a cause of rear-end highway collisions. The human visual system does contain binocular mechanisms sensitive to speed. Simulated objects can be seen and recognized entirely on the basis of texture differences. The physiological limit for locating a texture-defined boundary is 1.7 to 2.4 min are, and visual acuity for texture-defined gratings is above 7 c/deg. Spatial frequency discrimination threshold is approx. 5% for both texture-defined and luminance-defined gratings for frequencies less that 3 - 4 c/deg.
DTIC
Visual Acuity; Visual Perception; Auditory Perception; Sensitivity; Discrimination; Flight Simulators; Collision Avoidance

20000053024 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Current USN/USMC Aircraft Anthropometric Compatibility Issues and the "Street to Fleet" Proposal
Tucker, Heather D.; Brattin, Lori L.; Jan. 2000; 7p; In English
Report No.(s): AD-A375810; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Shortcomings of the USN/USMC anthropometric compatibility process have driven a requirement for an improved process, "Street to Fleet". During the course of the NAVAIRSYSCOM (PMA-202) Aircrew Accommodation Expansion Program (reference I), where AIR 4.6, Patuxent River was tasked to perform accommodation evaluations on in-service USN/USMC inventory, the increased costs associated with safely assigning aviators to an appropriate training curriculum through to their fleet aircraft have been identified. Both the shortcomings and increased costs are due in part to the lack of solid legacy guidance. Currently, four anthropometric measurements receive a "code" that indicates whether a particular candidate is compatible, incompatible, or requires a "fit check". Under current official guidance, a short sitting height is the only anthropometric measurement that receives an incompatible Anthropometric Restriction Code (ARC) with a given aircraft, primarily due to inadequate over the nose visibility. Newer aircraft are designed with the intent of accommodating an increased proportion of anthropometric extremes and these anthropometric parameters are considered simultaneously vice one dimension at a time. Therefore, the process used to screen aviators needs to more closely relate to the specification guidance used to develop the aircraft.
DTIC
Man Machine Systems; Anthropometry; Aircraft Pilots; Compatibility

20000053091 Wilmer Ophthalmological Inst., Wilmer Ophthalmological Inst., Baltimore, MD USA
Visual Motion Perception *Final Report, 15 Mar. 1997-14 Dec. 1998*
Turano, Kathleen A.; Mar. 06, 2000; 85p; In English
Contract(s)/Grant(s): F49620-97-1-0028
Report No.(s): AD-A375117; 52-0595110; AFRL-SR-BL-TR-00-0075; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In operations of aircraft control or target acquisition, the misperception of motion could produce serious errors in a pilot's performance. Little is known about the human observer's ability to accurately judge the velocity of motion while navigating through an environment containing moving objects or while making eye movements. If we can understand how the perception of motion is affected by the presence of moving objects in the environment or by eye movements, we can then specify viewing requirements based on the perceptual cost/benefits. In this project, the human observer's ability to judge velocity was investigated in two sets of experiments. In the first set of experiments the ability to judge self motion in an environment containing moving objects was investigated using simulated optic flow displays. The effects of object and observer velocity on the ability to discriminate between curvilinear and rectilinear self motion were determined. In the second set of experiments, the ability to judge object velocity while making smooth pursuit eye movements was investigated. The effects of stimulus velocity, size, and eccentricity on velocity perception were determined. The findings from the eye movement experiments led to the development of a model that explains how eye velocity signals combine with visual motion signals to determine the perception of motion.
DTIC
Visual Perception; Motion Perception; Perceptual Errors; Display Devices; Visual Stimuli; Target Acquisition; Aircraft Control

15
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science.

20000048276 Washington Univ., Dept. of Mechanical Engineering, Saint Louis, MO USA
High Performance Computing for Engineering Analysis and Design *Final Report, 1 May - 31 Dec. 1997*
Szabo, Barna A.; Dec. 31, 1997; 18p; In English
Contract(s)/Grant(s): F49620-97-1-0268
Report No.(s): AD-A375945; CCM-99-02; AFRL-SR-BL-TR-00-0102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant was used for upgrading an SGI Power Challenge L supercomputer and for the acquisition of 3 SGI O2 workstations to serve DoD research projects in three general areas: (1) Research on the p- and hp-versions of the Finite Element Method conducted by the Center for Computational Mechanics. (2) Research on non-linear control systems conducted in the Department of Systems Science and Mathematics. (3) Rotorcraft analysis and simulation conducted in the Department of Mechanical Engineering.
DTIC
Mechanical Engineering; Reliability Analysis; Stress Analysis; Aircraft Design; Computer Aided Design; Control Systems Design

20000050245 Technische Hogeschool Twente, Centre for Telematics and Information Technology, Enschede, Netherlands
Using the Tools in TRADE III: A Controller for a Compact Dynamic Bus Station
Wieringa, R. J., Technische Hogeschool Twente, Netherlands; 2000; 36p; In English
Report No.(s): PB2000-104705; CTIT-TR-99-15; Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Introduction; Business Requirements; System Requirements; Essential Architecture; Discussion; Specification Dictionary.
NTIS
Computer Programs; Commerce; Ground Effect Machines

20000055731 NASA Ames Research Center, Moffett Field, CA USA
Formal Analysis of the Remote Agent Before and After Flight
Havelund, Klaus, RECOM Technologies, Inc., USA; Lowry, Mike, NASA Ames Research Center, USA; Park, SeungJoon, Research Inst. for Advanced Computer Science, USA; Pecheur, Charles, Research Inst. for Advanced Computer Science, USA; Penix, John, NASA Ames Research Center, USA; Visser, Willem, Research Inst. for Advanced Computer Science, USA; White, Jon L., Caelum Research Corp., USA; Lfm2000: Fifth NASA Langley Formal Methods Workshop; June 2000; 12p; In English; See also 20000055716; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes two separate efforts that used the SPIN model checker to verify deep space autonomy flight software. The first effort occurred at the beginning of a spiral development process and found five concurrency errors early in the design cycle that the developers acknowledge would not have been found through testing. This effort required a substantial manual modeling effort involving both abstraction and translation from the prototype LISP code to the PROMELA language used by SPIN. This experience and others led to research to address the gap between formal method tools and the development cycle used by software developers. The Java PathFinder tool which directly translates from Java to PROMELA was developed as part of this research, as well as automatic abstraction tools. In 1999 the flight software flew on a space mission, and a deadlock occurred in a sibling subsystem to the one which was the focus of the first verification effort. A second quick-response "cleanroom" verification effort found the concurrency error in a short amount of time. The error was isomorphic to one of the concurrency errors found during the first verification effort. The paper demonstrates that formal methods tools can find concurrency errors that indeed lead to loss of spacecraft functions, even for the complex software required for autonomy. Second, it describes progress in automatic translation and abstraction that eventually will enable formal methods tools to be inserted directly into the aerospace software development cycle.
Author
Computer Programming; Software Engineering; Flight Control; Systems Engineering

20000057502 NASA Goddard Space Flight Center, Greenbelt, MD USA
Autonomous Performance Monitoring System: Monitoring and Self-Tuning (MAST)
Peterson, Chariya, Computer Sciences Corp., USA; Ziyad, Nigel A., NASA Goddard Space Flight Center, USA; [2000]; 10p; In

English; SpaceOps, 19-23 Jun. 2000, Toulouse, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Maintaining the long-term performance of software onboard a spacecraft can be a major factor in the cost of operations. In particular, the task of controlling and maintaining a future mission of distributed spacecraft will undoubtedly pose a great challenge, since the complexity of multiple spacecraft flying in formation grows rapidly as the number of spacecraft in the formation increases. Eventually, new approaches will be required in developing viable control systems that can handle the complexity of the data and that are flexible, reliable and efficient. In this paper we propose a methodology that aims to maintain the accuracy of flight software, while reducing the computational complexity of software tuning tasks. The proposed Monitoring and Self-Tuning (MAST) method consists of two parts: a flight software monitoring algorithm and a tuning algorithm. The dependency on the software being monitored is mostly contained in the monitoring process, while the tuning process is a generic algorithm independent of the detailed knowledge on the software. This architecture will enable MAST to be applicable to different onboard software controlling various dynamics of the spacecraft, such as attitude self-calibration, and formation control. An advantage of MAST over conventional techniques such as filter or batch least square is that the tuning algorithm uses machine learning approach to handle uncertainty in the problem domain, resulting in reducing over all computational complexity. The underlying concept of this technique is a reinforcement learning scheme based on cumulative probability generated by the historical performance of the system. The success of MAST will depend heavily on the reinforcement scheme used in the tuning algorithm, which guarantees the tuning solutions exist.

Author

Algorithms; Applications Programs (Computers); Flight Control; Procedures; Accuracy

20000054885 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Reconfigurable Control for the Formation Flying of Multiple Spacecraft

Mesbahi, Mehran, Jet Propulsion Lab., California Inst. of Tech., USA; Hadaegh, Fred Y., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several results on the reconfigurable control architecture for the formation flying of multiple spacecraft are presented. In this direction, simple control laws are combined with logic-based switching to propose a hybrid control architecture for leader reassignment, leader-following capturing, and dealing with control saturations.

Author

Control Theory; Flight Control; Spacecraft Control; Directional Control

20000055721 Azimuth, Inc., Fairmont, WV USA

Modeling the Fault Tolerant Capability of a Flight Control System: An Exercise in SCR Specification

Alexander, Chris, Azimuth, Inc., USA; Cortellessa, Vittorio, West Virginia Univ., USA; DelGobbo, Diego, West Virginia Univ., USA; Mili, Ali, West Virginia Univ., USA; Napolitano, Marcello, West Virginia Univ., USA; Lfm2000: Fifth NASA Langley Formal Methods Workshop; June 2000; 12p; In English; See also 20000055716; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In life-critical and mission-critical applications, it is important to make provisions for a wide range of contingencies, by providing means for fault tolerance. In this paper, we discuss the specification of a flight control system that is fault tolerant with respect to sensor faults. Redundancy is provided by analytical relations that hold between sensor readings; depending on the conditions, this redundancy can be used to detect, identify and accommodate sensor faults.

Author

Fault Tolerance; Failure Analysis; Flight Control; Fault Detection

16
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics.

20000044881 NASA Ames Research Center, Moffett Field, CA USA

Summary of HEAT 1 Aeroacoustics Installation Effects

Smith, Brian E., NASA Ames Research Center, USA; Zuniga, Fanny A., NASA Ames Research Center, USA; Soderman, Paul T.; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 3, pp. 1407-1452; In English; See also 20000044865; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A critical part of the NASA High-Speed Research (HSR) program is the demonstration of satisfactory suppression of the jet noise present at low airspeeds. One scheme for reducing jet exhaust noise generated by a future High-Speed Civil Transport

(HSCT) is the use of a mixer/ ejector system which would entrain large quantities of ambient air into the exhaust flow from the powerplant in order to cool and slow the jet exhaust before it leaves the tailpipe. of the variety of factors which can affect the noise suppression characteristics of the mixer/ejector system, the influence of the wing flow field and high-lift devices is not well understood. The effectiveness of the noise suppression device must be evaluated in the presence of the wing/high-lift system before definitive assessments can be made concerning HSCT noise. Of nearly equal importance is the evaluation of the performance of the high-lift system(s) in the presence of realistic propulsion units which feature high ambient flow entrainment rates and jet thrust coefficients. These noise suppressors must provide the required acoustic attenuation while not overly degrading the thrust efficiency of the propulsion system or the lift enhancement of the high-lift devices on the wing. The overall objective of the NASA High-lift Engine Aeroacoustics Technology program is to demonstrate satisfactory interaction between the jet noise suppressor and the high-lift system at airspeeds and angles of attack consistent with takeoff, climb, approach, and landing. In support of this program, an isolated aeroacoustic test of a 13.5%-scale, candidate mixer/ejector nozzle was performed in the Ames' Research Center 40- by 80-Foot Wind Tunnel. The purpose of the test was to measure the baseline aeroacoustic performance characteristics of this nozzle in isolation from the aerodynamic flowfield induced by an HSCT airframe. The test documented the acoustic signature of the nozzles with treated and hardwall ejector surfaces and with changes in the ratio of ejector-duct-to-jet-area over a wide range range of nozzle pressure ratios and freestream Mach numbers. The test also measured the thrust performance, ambient-flow aspiration ratio, and internal and external static pressures on the nozzles. The isolated aeroacoustic performance data has been compared with results obtained with this nozzle installed on a 13.5% Boeing Reference H HSCT configuration, semi-span model. The semi-span, aeroacoustics integration test documented the first-order effects of the airframe flowfield on the acoustic performance of the nozzle and the effect of the nozzle secondary inlet flows on the aerodynamic performance of the wing high-lift systems. This investigation is critical to understanding the mutual installation effects of mixer/ejector nozzles and wing high-lift systems.
Derived from text
Acoustic Attenuation; Acoustic Properties; Aeroacoustics; Jet Aircraft Noise; Aerodynamic Noise; Noise Reduction; Mixers; Ejectors; Nozzle Flow; Exhaust Nozzles; Wind Tunnel Tests

20000053514 National Aerospace Lab., Flight Div., Amsterdam, Netherlands
Research on Noise Abatement Procedures
Erkelens, L. J. J., National Aerospace Lab., Netherlands; Feb. 1998; 32p; In English; 10th; Aviation-2000 Prospects Symposium, 19-24 Aug. 1997, Zhukovsky, Amsterdam, Russia, Netherlands; Original contains color illustrations
Report No.(s): PB2000-103820; NLR-TP-98066; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This paper focuses on the noise abatement problem around major airports. Special attention is paid to the noise regulations as applied to Amsterdam Airport Schiphol. A series of technical operational measures is subject of current NLR research. The objective of this research is to investigate how community noise, caused by arriving and departing aircraft, can be reduced without degradation of the present level of safety and without significant reduction of airport capacity during peak hours. Two noise abatement procedures, the subject of this research at NLR, are highlighted. These concern a concept for an advanced approach procedure (ACDA) and an advanced procedure for flying Standard Instrument Departures. Results of preliminary research are shown and a combined flight and ATC simulation program, to be carried out in the near future, is explained.
NTIS
Noise Reduction; Air Traffic Control; Noise Pollution; Aircraft Noise

20000055364 Boston Univ., Coll. of Engineering, Boston, MA USA
Analytical Representations of Fluid-Structure Interaction Noise Predicted From Large Simulations ***Final Report, 1 May 1999-27 Mar 2000***
Howe, M. S.; Mar. 27, 2000; 53p; In English
Contract(s)/Grant(s): N00014-99-1-0391
Report No.(s): AD-A375900; AM-00-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Approximations are derived for the three-dimensional Green's function for an airfoil of finite thickness and chord for sources near the leading or trailing edge. The acoustic wavelength is large relative to the airfoil thickness, but no restriction is placed on its magnitude relative to the chord. Extension is made to production of sound by flow over the trailing edge of an airfoil with a single detached flap. Green's function is derived for a detached flap at relative angle of attack a when the chord of the flap is acoustically compact. Formulae are given for calculating the 'self-noise' produced by boundary layer instability; the efficiency

of sound generation at the edge of the airfoil is shown to be typically at least 7 dB larger than that produced at the trailing edge of the flap. The results can be incorporated into a numerical scheme for predicting airfoil noise at low Mach numbers.
DTIC
Turbulent Flow; Boundary Layer Flow; Flaps (Control Surfaces); Green'S FUNCTIONS; Vortices; Simulation; Sound Waves; Flapping

20000057338 NASA Langley Research Center, Hampton, VA USA
Potential Subjective Effectiveness of Active Interior Noise Control in Propeller Airplanes
Powell, Clemans A., NASA Langley Research Center, USA; Sullivan, Brenda M., NASA Langley Research Center, USA; May 2000; 38p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 522-81-14-01
Report No.(s): NASA/TM-2000-210122; NAS 1.15:210122; L-17976; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Active noise control technology offers the potential for weight-efficient aircraft interior noise reduction, particularly for propeller aircraft. However, there is little information on how passengers respond to this type of interior noise control. This paper presents results of two experiments that use sound quality engineering practices to determine the subjective effectiveness of hypothetical active noise control (ANC) systems in a range of propeller aircraft. The two experiments differed by the type of judgments made by the subjects: pair comparisons based on preference in the first and numerical category scaling of noisiness in the second. Although the results of the two experiments were in general agreement that the hypothetical active control measures improved the interior noise environments, the pair comparison method appears to be more sensitive to subtle changes in the characteristics of the sounds which are related to passenger preference. The reductions in subjective response due to the ANC conditions were predicted with reasonable accuracy by reductions in measured loudness level. Inclusion of corrections for the sound quality characteristics of tonality and fluctuation strength in multiple regression models improved the prediction of the ANC effects.
Author
Effectiveness; Active Control; Sensitivity; Propeller Noise; Noise Reduction; Aircraft Noise

20000057467 NASA Langley Research Center, Hampton, VA USA
Flap Edge Aeroacoustic Measurements and Predictions
Brooks, Thomas F., NASA Langley Research Center, USA; Humphreys, William M., Jr., NASA Langley Research Center, USA; [2000]; 30p; In English; 6th; 6th Aeroacoustics Conference, 12-14 Jun. 2000, Hahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1975; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An aeroacoustic model test has been conducted to investigate the mechanisms of sound generation on high-lift wing configurations. This paper presents an analysis of flap side-edge noise, which is often the most dominant source. A model of a main element wing section with a half-span flap was tested at low speeds of up to a Mach number of 0.17, corresponding to a wing chord Reynolds number of approximately 1.7 million. Results are presented for flat (or blunt), flanged, and round flap-edge geometries, with and without boundary-layer tripping, deployed at both moderate and high flap angles. The acoustic database is obtained from a Small Aperture Directional Array (SADA) of microphones, which was constructed to electronically steer to different regions of the model and to obtain farfield noise spectra and directivity from these regions. The basic flap-edge aerodynamics is established by static surface pressure data, as well as by Computational Fluid Dynamics (CFD) calculations and simplified edge flow analyses. Distributions of unsteady pressure sensors over the flap allow the noise source regions to be defined and quantified via cross-spectral diagnostics using the SADA output. It is found that shear layer instability and related pressure scatter is the primary noise mechanism. For the flat edge flap, two noise prediction methods based on unsteady-surface-pressure measurements are evaluated and compared to measured noise. One is a new causality spectral approach developed here. The other is a new application of an edge-noise scatter prediction method. The good comparisons for both approaches suggest that much of the physics is captured by the prediction models. Areas of disagreement appear to reveal when the assumed edge noise mechanism does not fully define, the noise production. For the different edge conditions, extensive spectra and directivity are presented. Significantly, for each edge configuration, the spectra for different flow speeds, flap angles, and surface roughness were successfully scaled by utilizing aerodynamic performance and boundary layer scaling method developed herein.
Author
Flapping; Aeroacoustics; Aerodynamic Noise; Computational Fluid Dynamics; Data Bases; Diagnosis; Mathematical Models; Noise Generators; Noise Prediction; Prediction Analysis Techniques; Pressure Measurement

20000057531 Wyle Labs., Inc., Arlington, VA USA
Examination of the Lateral Attenuation of Aircraft Noise
Plotkin, Kenneth J., Wyle Labs., Inc., USA; Hobbs, Christopher M., Wyle Labs., Inc., USA; Bradley, Kevin A., Wyle Labs., Inc., USA; April 2000; 64p; In English
Contract(s)/Grant(s): NAS1-20103; RTOP 538-03-15-01
Report No.(s): NASA/CR-2000-21011; NAS 1.26:210111; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Measurements of the lateral attenuation of noise from aircraft operations at Denver International Airport were made at distances up to 2000 feet and elevation angles up to 27 degrees. Attenuation Calculated from modem ground impedance theory agrees well with average measured attenuation. The large variability between measured and predicted levels observed at small elevation angles is demonstrated to be due to refraction by wind and temperature gradients.
Author
Aircraft Noise; Noise Measurement; Atmospheric Temperature; Impedance

17
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000057330 Research and Technology Organization, Neuilly-sur-Seine, France
Multilingual Aeronautical Dictionary ***Dictionnaire Aeronautique Multilingue***
January 1980; In English; CD-ROM contains full text document in PDF format in English, French, Dutch, German, Greek, Italian, Portuguese, Russian, Spanish and Turkish; Supersedes ISBN 92-835-01666-7 which is the hardcopy that went out of print in 1984
Report No.(s): LC-77-93566; ISBN 92-835-01666-7; Copyright Waived; Avail: CASI; C01, CD-ROM

In 1960, as part of its publications program, AGARD produced a Multilingual Aeronautical Dictionary, for which, in 1963, it issued a supplement. Since 1963, substantial technological advances have taken place, and many new terms have been introduced into the language of aeronautical research, development, and engineering. At the same time, many terms previously in current use are obsolescent. For these reasons, the original AGARD Multilingual Aeronautical Dictionary has been completely revised and updated. AGARD activities, conducted with the assistance of nine panels of eminent scientists and engineers form NATO Member-Nations, cover the diverse fields of aerospace technology. Each of the panels participated in the preparation of the revised dictionary, under the direction of the Technical Information Panel.
Derived from text
Dictionaries; Linguistics; Words (Language); Aeronautics

18
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences.

20000056252 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
New Millenium Program Serving Earth and Space Sciences
Li, Fuk, Jet Propulsion Lab., California Inst. of Tech., USA; Mar. 18, 1999; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A cross-Enterprise program is to identify and validate flight breakthrough technologies that will significantly benefit future space science and earth science missions. The breakthrough technologies are: enable new capabilities to meet earth and space science needs and reducing costs of future missions. The flight validation are: mitigates risks to first users and enables rapid technology infusion into future missions.
Derived from text
Flight Safety; Cost Reduction; Technology Assessment; Technology Transfer

20000056134 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Mars Express Subsurface Sounding Radar: Water and Ice Detection in the Polar Regions
Plaut, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; The First International Conference on Mars Polar Science and Exploration; [1998], pp. 31; In English; See also 20000056101; No Copyright; Avail: Issuing Activity; Abstract Only

The European Space Agency (ESA) will conduct a mission to Mars during the 2003 launch opportunity, called Mars Express. Much of the payload is similar to that of the failed Mars 96 orbiter, but a completely new instrument has been selected for the payload, the Subsurface Sounding Radar/Altimeter (SSRA). The SSRA experiment is a joint project between the University of Rome, the Jet Propulsion Laboratory, and Alenia Aerospazio, Italy. This paper describes the science objectives of the experiment, the instrument characteristics, and applications of the SSRA investigation to studies of the martian polar regions. Science Objectives: The primary objective of the SSRA experiment is to map the distribution of water, both liquid and solid, in the upper portions of the crust of Mars. Secondary objectives include subsurface geologic probing for stratigraphic and structural contacts, characterization of the surface topography, roughness and reflectivity, and ionospheric sounding. Detection of water and ice reservoirs will address many key issues in the hydrologic, geologic, climatic and possible biologic evolution of Mars, including the current and past global inventory of water, mechanisms of transport and storage of water, the role of liquid water and ice in shaping the landscape of Mars, the stability of liquid water and ice at the surface as an indication of climatic conditions, and the implications of the hydrologic history for the evolution of possible martian ecosystems. Models of the radar system performance and electromagnetic interactions with martian crustal materials indicate that aquifers of liquid water can be detected by SSRA to a depth greater than 5km under favorable conditions of surface roughness and crustal composition. Under less favorable conditions penetration depths may be substantially smaller; in these circumstances, the distribution of ground ice and the nature of the shallow stratigraphy may nevertheless be studied. The SSRA is a multifrequency, coherent pulse, synthetic aperture radar sounder/altimeter. The instrument features flexibility in frequency selection for adaptation to the Mars environment, and a secondary, receive-only antenna and data channel to minimize the effects of surface "clutter" on subsurface feature detection. The instrument will acquire echo profiles of the subsurface of Mars at a lateral spacing of approximately 5 km and a vertical (depth) resolution of 50-100m. Four frequency channels will be available for use: 1.9, 2.8, 3.8, and 4.8 MHz. The lower frequency channels, which are likely to penetrate more deeply, will be used during night-side operations, when the ionospheric plasma frequency is lowest. The primary antenna consists of a simple dipole with a total length of 40m. An impedance matching system will be used to improve antenna efficiency across the range of frequencies. The secondary antenna is designed with a null in its pattern at the spacecraft nadir, and will therefore primarily detect echoes from off nadir surface structure (clutter). Onboard digital processing will generate echo profiles for both the primary and secondary receive streams, at two frequencies in the nominal mode. This processing greatly reduces the data volume necessary for downlink. Postprocessing on Earth will include convolution of the primary and secondary antenna profiles for surface clutter cancellation, and compilation of map products showing, for example, the depth of detected interfaces. Science Objectives: The primary objective of the SSRA experiment is to map the distribution of water, both liquid and solid, in the upper portions of the crust of Mars. Secondary objectives include subsurface geologic probing for stratigraphic and structural contacts, characterization of the surface topography, roughness and reflectivity, and ionospheric sounding. 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Data from SSRA can potentially address several critical issues in Mars polar studies. of particular interest is the depth and character of the "bed" of the polar layered deposits. If attenuation of the signal by the layered materials is not too great, it may be possible to map the base of the deposit and detect basal melting zones, should they exist. Detection of pockets of liquid water beneath the ice would be a dramatic result, with implications for possible ecosystems and regional or global hydrologic systems. Strong discontinuities in dielectric properties may also be detected within the layered deposits and may be indicative of major climate shifts. Properties of other high-latitude terrains will be studied, including the thickness of the north polar erg and possible subsurface stratigraphic contacts among sedimentary and volcanic units in both polar regions. Contacts between ice-saturated and ice-free crustal materials are likely to be detected in some regions. The thickness of the proposed low-latitude desiccation zone may be measurable. Additional information contained in the original.

Author

Altimeters; Detection; Ground Water; Ice; Mars (Planet); Mars Environment; Mars Surface; Polar Regions; Radio Altimeters; Sounding; Topography; Water

20000056603 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Mars Microprobe Mission: Advanced Micro-Avionics for Exploration Surface

Blue, Randel, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 7p; In English; No Copyright; Avail: CASI; A02,

Hardcopy; A01, Microfiche

The Mars Microprobe Mission is the second spacecraft developed as part of the New Millennium Program deep space missions. The objective of the Microprobe Project is to demonstrate the applicability of key technologies for future planetary missions by developing two probes for deployment on Mars. The probes are designed with a single stage entry, descent, and landing system and impact the Martian surface at speeds of approximately 200 meters per second. The microprobes are composed of two main sections, a forebody section that penetrates to a depth below the Martian surface of 0.5 to 2 meters, and an aftbody section that remains on the surface. Each probe system consists of a number of advanced technology components developed specifically for this mission. These include a non-erosive aeroshell for entry into. the atmosphere, a set of low temperature batteries to supply probe power, an advanced microcontroller to execute the mission sequence, collect the science data, and react to possible system fault conditions, a telecommunications subsystem implemented on a set of custom integrated circuits, and instruments designed to provide science measurements from above and below the Martian surface. All of the electronic components have been designed and fabricated to withstand the severe impact shock environment and to operate correctly at predicted temperatures below -100 C.

Author

Mars Surface; Application Specific Integrated Circuits; Fabrication; Forebodies; Landing Aids; Microanalysis; Temperature Probes

Subject Term Index

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Personal Author Index

T

U

V

W

Y

Z

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